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DECEMBER 4, 1937

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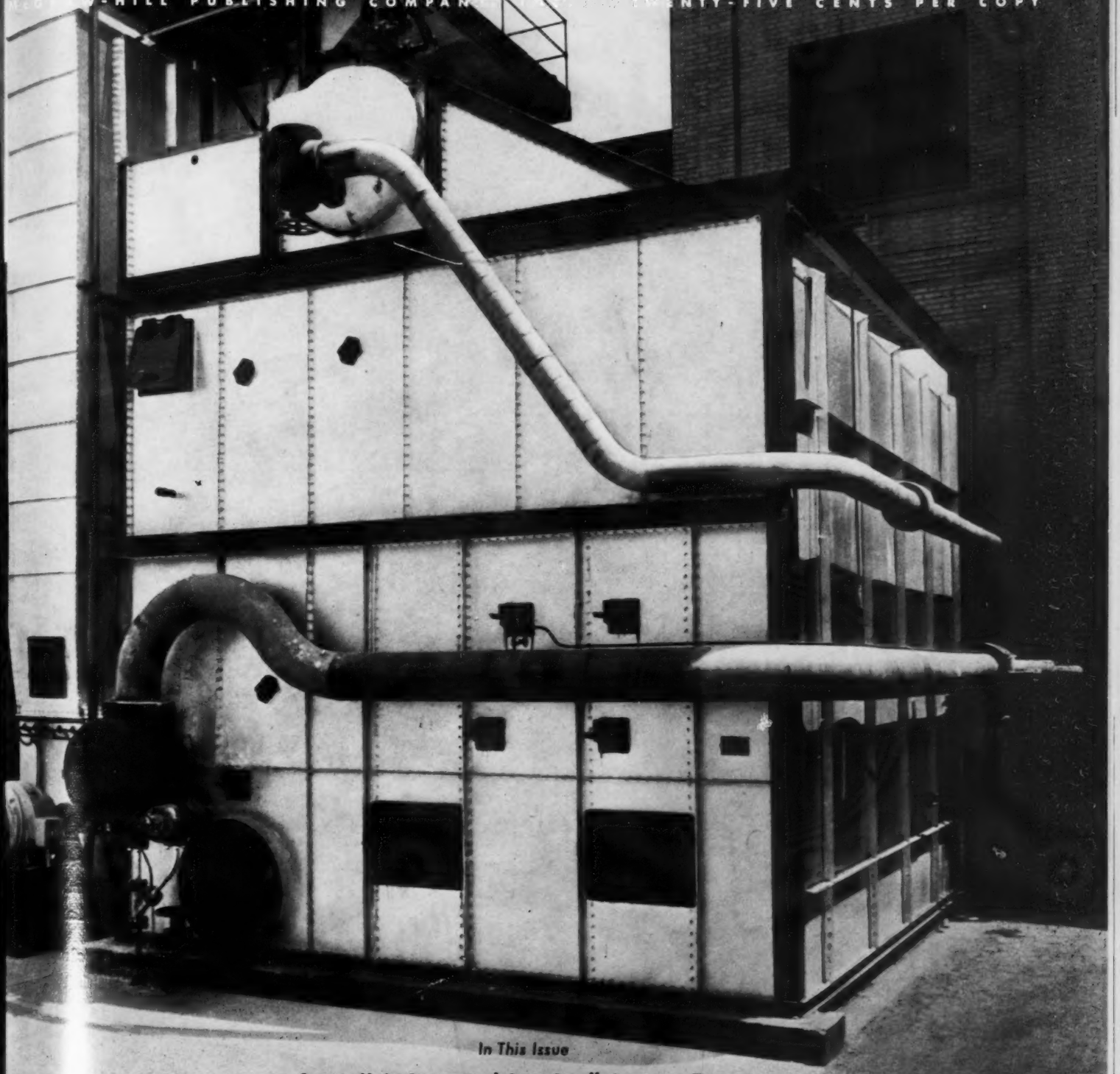

In This Issue

Steam Unit Compacted Into Small Space at Tucson

(Outdoor Boiler With Venturi Furnace Stack Shown)

NEWS OF THE WEEK Page 69

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Coming Features

Pilot Wire Relaying Gives Tie-Line Protection

A protective system that quickly isolates tie-line faults but that is non-operative on faults at other points in the interconnected systems of the Puget Sound Power & Light Company and the Seattle Lighting Department will soon be described by Trueman T. Smith.

Transportation Equipment for Heavy Construction

Harold J. Martin of Department of Water and Power, Los Angeles, will describe the trucks that have been designed to carry cranes, winches, pumps and tools for heavy construction on the extensive Los Angeles system.

The House With the Golden Windows

How the Wisconsin Power & Light Company, Madison, increased its average residential usage 75 kw.-hr. per year by the active promotion of residential lighting will soon be told in a fascinating feature story by H. W. Copper, vice-president.

On the Cover

The outdoor boiler plant that serves the compact steam turbine installation at Tucson, Ariz., is shown on the cover of this issue. An article on page 49 shows pictures of other elements of the plant and tells how the 6,250-kw. power unit was compacted into a 20x30-ft. space.

CONTENTS

DECEMBER 4, 1937

Steam Unit Compacted Into Small Space 49

Structure Insulated to Isolate Ground Faults 52

Better Protection for High-Voltage Motors 55

Better Test Results From New Meter Boards 57

What They Said on TVA 59

Fuse Primaries Even When Using Reclosers 60

One Modernized Lighting Layout 61

Microtomic Wafers Reveal Cable Voids 62

Commercial Data Sheets Developed as Sales Tool 64

Carter Field on Washington Events 68

Editorials	47 and 66	Manufacturing and Markets	112
Field Operating Practices	79	New Equipment	120
New Engineering Ideas	88	Sales Opportunities	127
Industrial Electrification	94	Recent Rate Changes	132
Building Up the Load	100	Municipal Items	133
News About People	104	Index of Advertisements	146

NEWS OF THE WEEK

Page 69

VOLUME 108 . . . NUMBER 23

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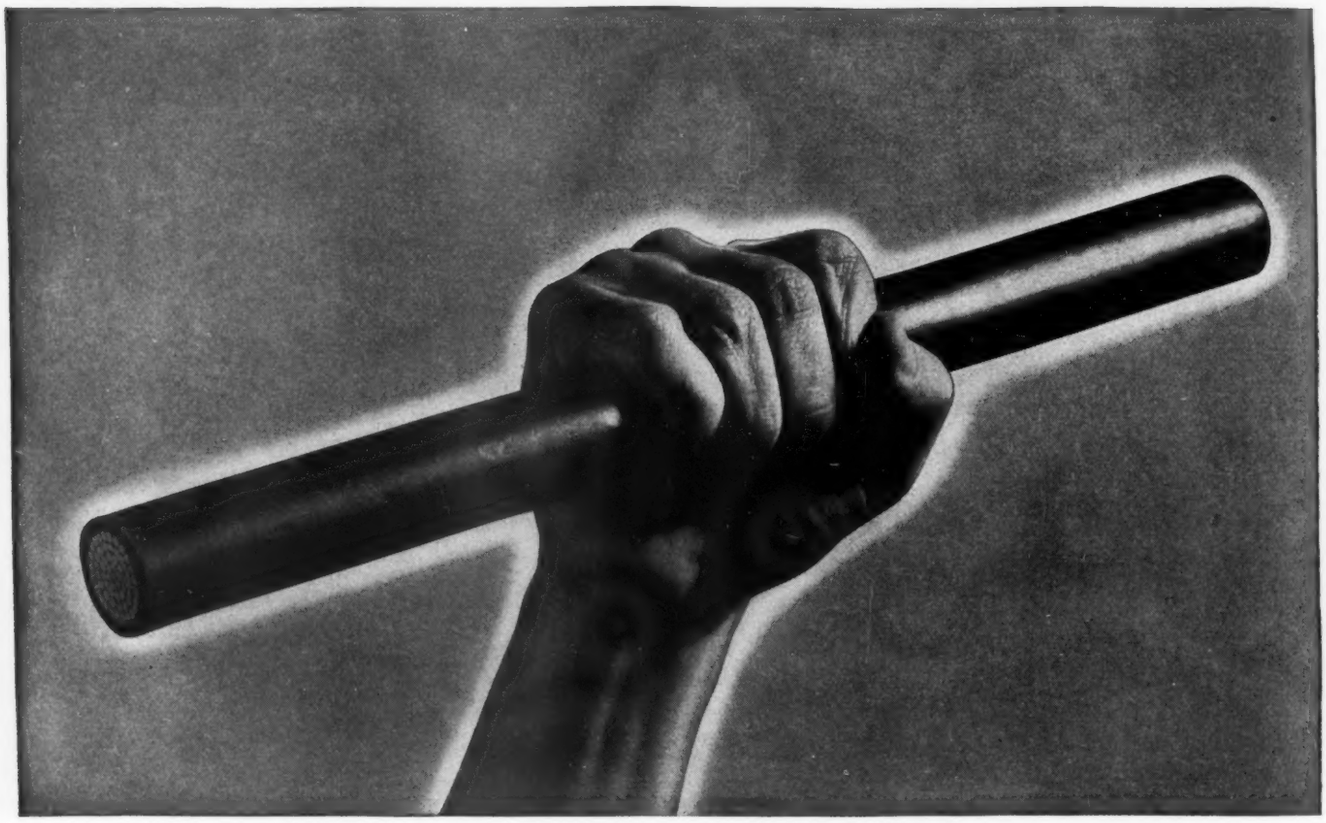

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ELECTRICAL WORLD

DECEMBER 4, 1937

The Price of Peace

While the conferences which the President is holding with individual power company executives, although only two in number so far, indicate that conversations relating to government co-operation with the utility industry are predicated upon the acceptance of the "prudent investment" rate base theory, there is no indication as to what the Administration will offer in return.

It is not going to be easy for an industry that for thirty-nine years has operated under broad provisions of the Smythe vs. Ames decision to accept a theory of valuation that ignores everything but historical cost. But if this is the price which the industry must pay to secure relief from the governmental restraints that have frightened investors, then the industry would be wisely advised to accept the theory in principle, with such modifications as will make it practical. What will happen under greatly different price levels, however, is a bridge that need not be crossed ahead of time.

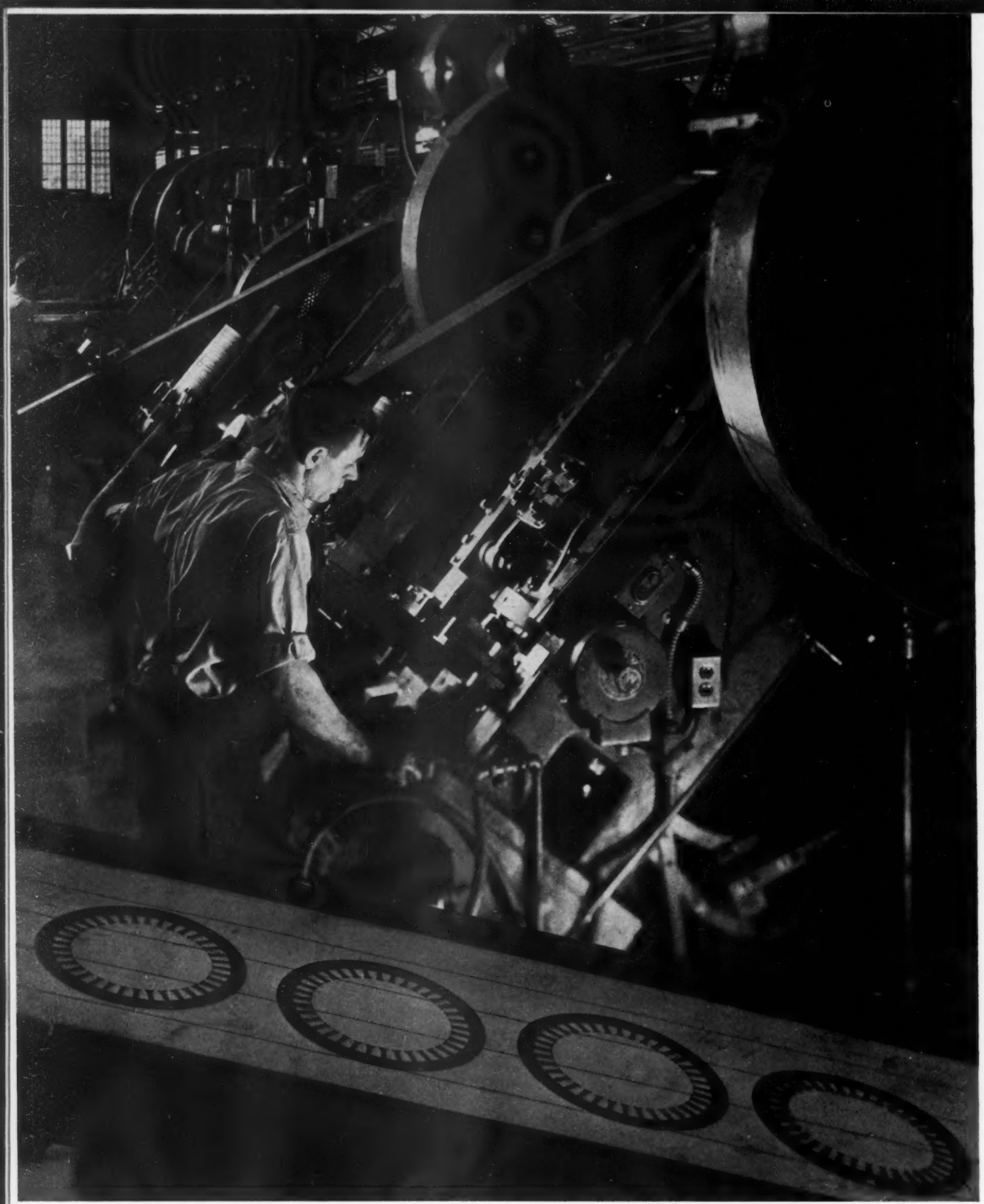
In return for acceptance of this theory of valuation, what kind of relief will the industry secure? Is the President going to insist on retention of the death sentence clause in the Utility Act, or the continuance of the present TVA and other federal power project programs, complete with "yardstick" and duplication of facilities and such other detrimental activities already in operation, such as PWA subsidies to municipalities, promising only no new hurtful activities, or is he going to be willing to modify present laws and programs where they clearly work an injustice on the industry?

If the President has no definite plan, but is awaiting the suggestions of the industry, he should, if enough men are invited to the White House, be able to get a good cross-section of utility opinion out of which a workable plan might be evolved. Already one such plan has been offered by Wendell Willkie, president of Commonwealth & Southern, and the first of the utility executives to confer with Mr. Roosevelt. The details of that plan, which will be found elsewhere in this issue, will be studied with considerable interest inasmuch as the plan represents the views of the managements of properties most directly affected by federal power policies and might therefore be expected to contain all of the elements of primary interest to the investor and the public.

It will be most unfortunate if the President limits these conferences to a small number of men, and then very largely to people representing utility properties that are not now or likely to be affected by federal power projects, or the death sentence clause in the Utility Act. After all, it is money that is cut on strike, and an honest effort to restore the investor's confidence in the future of the industry must be made if utility buying is to pull its weight in the revival of the durable goods industry.

Extravagant statements as to new construction that will result from relief from punitive measures should not blind the conferees as to the true facts. After all, the industry is regulated, and it cannot go on a wild orgy of spending without knowing where the money is coming from and how fast it can be made to earn a return.

What the industry wants is to be able to go ahead in a normal manner. That in itself can, under the right conditions, involve the expenditure of a billion dollars a year.



COOKIE MACHINES

From this battery of inclined punch presses, operating at 65 strokes per minute, come the stator laminations or "cookies" for the industrial a.c. motors made in 1 to 50 hp. sizes on the new motor aisle of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. Ejected from the punch part of the die onto a chute, the laminations pass to an inclined double belt conveyor and eventually to an automatic stacker ready for weighing and riveting.

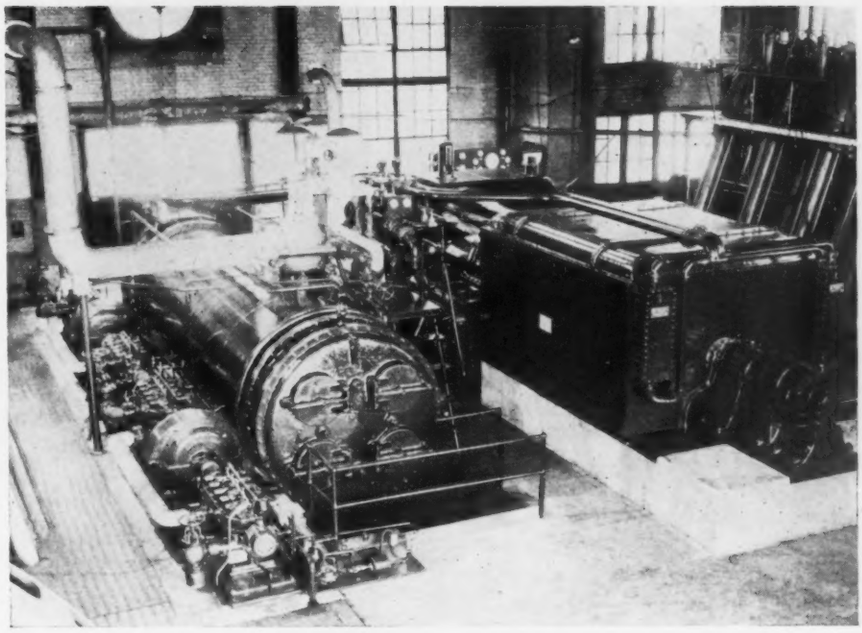


Fig. 1—Power kit embraces all but boiler

In order from right to left are the exciter, alternator (6,250 kva., 3,600 r.p.m.), turbine (with operating panel showing over it), steam chest, four-stage heater, condenser, four-stage boiler feed pumps. Some auxiliaries are in the flywheel pit of the former 360-kw. Corliss compound engine on the two foundations of which this compact installation has been made. The boiler is outdoors near the windows behind the panel.

Steam Unit Compacted Into Small Space

Boiler and Water Cooling Tower Outdoors at Tucson—Turbo-alternator, Condenser, Pumps and Auxiliaries Mounted on Old Corliss Engine Foundation—Performance Highly Satisfactory

By J. H. SAUNDERS

Superintendent of Power Production Tucson Gas, Electric Light & Power Company, Tucson, Ariz.

IN 1932, when the Tucson Gas, Electric Light & Power Company installed the ninth Diesel at its generating plant in the city of Tucson, Ariz., it was believed that, barring costly expansion of the building, a maximum of generating equipment had been installed. Once the largest central station Diesel plant on the continent, now the second largest, it appeared to have every foot of floor space put to work.

Hence, when growing loads in Tucson and adjacent areas served by the company made an addition to generating capacity imperative, an important question had to be faced. Where would the equipment be put?

It was the consideration of these space limitations, and the costs of overcoming them, that led to installation of the 6,250-kva. steam turbo-generator which was placed in operation this summer. Construction of an outside boiler, plus ingenious design (Fig. 1) of the prime mover, which allowed it to be mounted on the massive 20x30-ft. foundations of a former 360-kw. cross-compound Corliss engine, made this installation possible. It is flanked on either side by 3,000- and 4,000-kw. Diesel units.

The unit consists of an impulse-reaction type turbine, direct connected to a 6,250-kva., 80 per cent power factor, three-phase, 60-cycle, 3,600-r.p.m., 4,150-volt alternator, with exciter direct connected through a flexible coupling. The turbine is designed for 825-lb., 825 deg. F. steam at the turbine throttle, 2 in. absolute back pressure at the exhaust.

Indoor space available for everything but the boiler and water cooling tower was near a wall of the station house and this permitted adjacent location of the boiler outdoors. Condenser and pumps are on one section

of the Corliss foundation; the turbo-alternator is on the other. Other equipment stands in the space which was formerly devoted to the flywheel well.

Boiler placed outdoors

The boiler, a Babcock & Wilcox, integral type furnace, Class F 19AE, No. 16, is outdoor, sheet-metal covered. Its capacity is 75,000 lb. per hour of steam at 875 lb. gage, 825 deg. F. Heating surface is 6,501 sq.ft. The super-heater is a loop type, designed to give constant temperature over a wide variation of steam flow. The steam drum is fusion welded, 42 in. diameter, 3¼ in. thick at the tube holes. There is also a 36-in. diameter mud drum. All steel is open hearth, 70,000 lb. Furnace volume is 2,855 cu.ft. The boiler (see front cover) occupies a ground space 15x20 ft.

Fuel normally will be gas, although the furnace is equipped to fire oil as well. Fuel and air mixture is automatically controlled by a Bailey air flow-gas flow ratio meter. It is equipped with automatic forced draft damper control, the fire being manually regulated by the induced draft damper. Air passes through a counter-flow preheater (seen at the left in the boiler picture on the cover of this issue of ELECTRICAL WORLD), where its temperature is raised to 400 deg. F. before entering the four B&W "San Diego" gas burners. The boiler has three horizontal passes. Flue gas leaves the bottom of the boiler at about 630 deg. F. and leaves the air preheater at about 350 deg. F., through a "Thermix" induced draft stack.

Fan ratings are: Forced draft, maximum capacity, 24,000 cu.ft. per minute, driven by a 75-hp., 1,165-r.p.m. motor on one end of the shaft, a 40-hp., 865-r.p.m. motor on the other, speed changes being automatic; induced draft, maximum capacity, 31,200 cu.ft. per minute, same motor ratings, speed change manual.

Turbo-alternator has condenser alongside

It was particularly in the design and arrangement of the prime mover and alternator that considerable ingenuity was required. In addition to the premium on space, there was imposed the already-mentioned requirement that the equipment be mounted on an existing engine foundation.

Among the features of the unit, furnished by Allis Chalmers Manufacturing Company, introduced to meet these conditions, are the positioning of its parts and the design of the alternator frame for tilting so that the rotor may be removed over the turbine. This method of rotor removal, employed for the first time on the Tucson installation, eliminates the space ordinarily required at the exciter end of the unit.

Turbine and condenser are located side by side, the turbine having a side outlet exhaust. Centerline of the condenser is but slightly lower than that of the turbine. Air removal

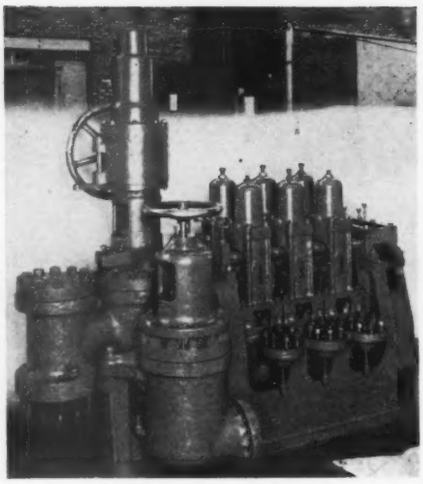


Fig. 2—Steam chest embraces supplementary valves

Two extra valves are provided to permit feeding in 150 lb. steam from existing low-pressure boilers and thus derive 2,000 kw. from the turbine in the event of outage of the high-pressure steam source.

pumps and four vertical heaters are located between turbine and condenser, while the two boiler feed pumps are located on the outer side of the condenser. Condenser hotwell and condensate pump are situated in the flywheel pit of the existing engine foundation. Surface type air coolers were built into the alternator frame, thus eliminating air ducts below the operating floor line.

Turbine—The turbine consists of a single Curtis stage followed by reaction blading, most of which is on a conical drum. All rotating blading is set directly in grooves in the solid turbine rotor, with which balanced piston and impulse wheel are integral.

Cylinder design

Of interest is the design used to keep the cylinder symmetrical and facilitate manufacture. The carbon-vanadium alloy steel section of the cylinder is carried down within four rows of the turbine exhaust. Four extraction nozzles are provided in the lower half of the cylinder for uncontrolled extraction for feedwater heating; one extraction point following the impulse stage and three extraction points along the reaction portion of the blading. As these three lower pressure extraction nozzles are all located in the steel section of the turbine cylinder, a large steam belt is provided at each nozzle by welded-in blade carrying rings. A similar ring is used to carry the labyrinth packing for the balance piston. This design aims to eliminate complicated coring and permits thorough inspection of cylinder castings.

High initial steam temperature necessitated a unique nozzle chamber arrangement. Each nozzle chamber is a separate casting welded into the cylinder, a construction which limits the amount of heat transmitted to the cylinder from the 825-deg. steam and provides sufficient flexibility to prevent cylinder distortion when a nozzle group is first put into service.

Turbine and alternator together have four bearings, the exciter two. The first, on the turbine, is a combined journal and Kingsbury thrust, the rest are conventional ball-and-socket self-aligning type. Turbine and alternator rotors are connected by a single-sleeve, claw-type flexible coupling.

Turbine sealing glands are combined labyrinth and water seal. To eliminate any effect of cylinder head distortion on the

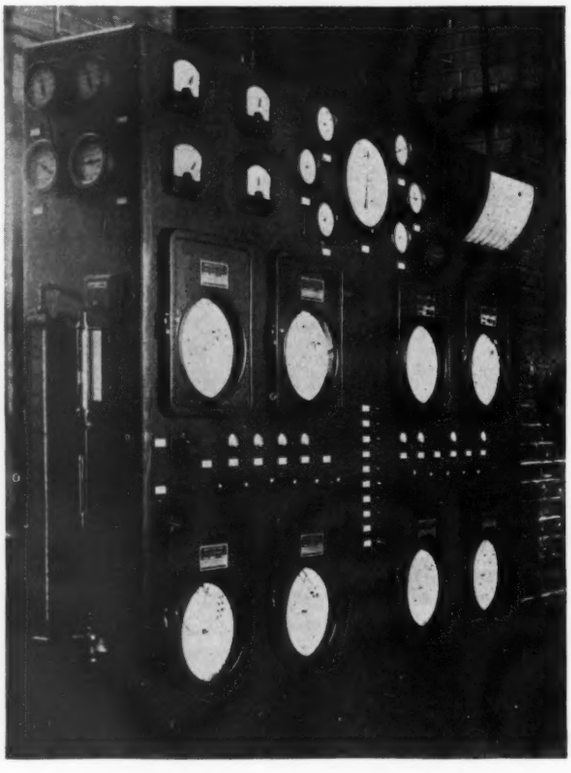


Fig. 3 — Remote control from this panel governs auxiliary as well as turbine output

Mounted on end bracket are the Mercury column vacuum gauge and barometer. Four G.E. indicating meters — kw., excitation, cycle, and bus voltage—in upper left-hand corner. Seven grouped meters —steam header pressure, pressure on four bleed heaters, condensate pump and boiler feed pump pressure in top center. Seven point draft and gas pressure gauge in upper right. Four recording meters, generator, air cooler, condenser water and hotwell, boiler feed temperature and drain heat exchanger are on the left. Four recording meters, steam flow, gas flow-air flow, steam and B.F. pressures, and flue gas temperature at right. Pistol grip controls for speed and load control in left center. Auxiliary control switches and ammeters, horizontal center. Red and green lights for indicating automatic valve positions and hotwell water level, vertical center.

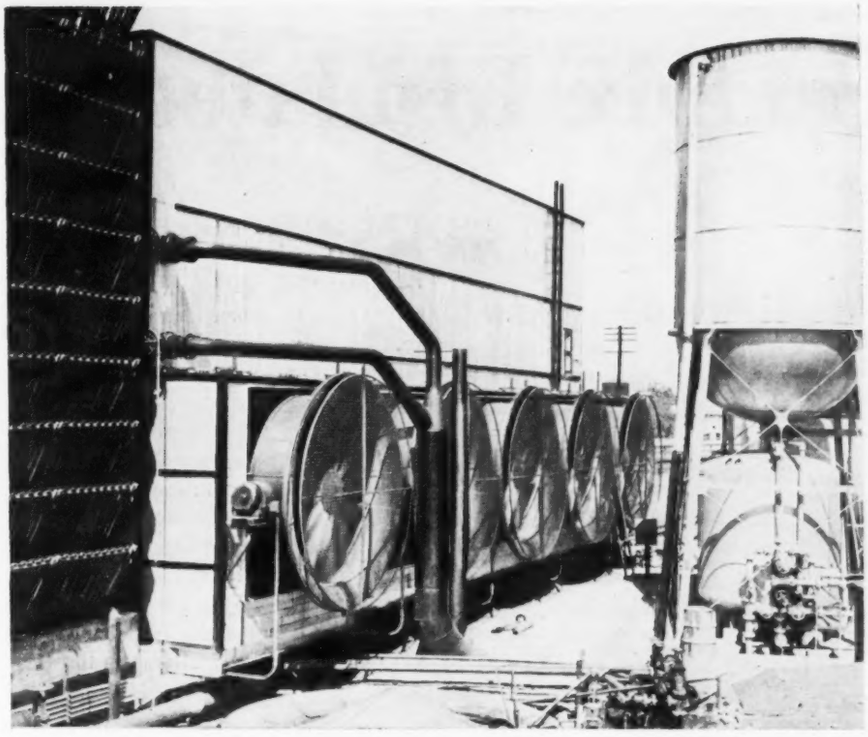


Fig. 4—Condensing water passes through cooling tower

Marley 5,000-g.p.m. cooling tower with forced draft. Note double header. At extreme left is the corner of 3,000-g.p.m. Braun natural draft tower. Condensate storage tank at extreme right, with part of water treatment plant below it.

high-pressure sealing gland clearances, this gland is bolted to the bearing housing and connected to the cylinder by means of a welded expansion joint.

Unique is the arrangement of steam gear. As shown in Fig. 2, steam strainer, high-pressure throttle valve, the six steam control valves and the low-pressure throttle valve, or bypass valve around the impulse stage for low-pressure operation, are combined in a single assembly, mounted on a separate baseplate.

Each of the steam control valves is connected to its nozzle group by a flexible steam pipe so that strains originating in the steam header piping will not be transmitted to the turbine cylinder. The endeavor is to aid smooth operation and good starting characteristics. The steam control valves are cam-operated against individual spring loading from an oil power cylinder on the opposite side of the turbine.

Governor gear includes two oil relay valves in series to attain close, positive speed regulation. The use of a small power relay to operate the oil relay on the oil power cylinder reduces the work required of the mechanical speed governor to a negligible quantity.

Fire protection

High steam temperature necessitated the location of all oil piping for both lubricating and governor systems on the opposite side of the turbine from the hot steam pipes. As an additional precaution against fire, oil pipes are located below the operating floor level wherever possible. Oil piping is 400-lb., standard seamless steel tubing with welded flange fittings, drain piping 300 lb.

Condenser—Principal problems in connection with the condenser were those which grew out of the side outlet turbine exhaust, particularly in regard to hotwell level control. Steam is led in through an inlet nozzle on the side of the shell, which is bolted directly to the turbine exhaust nozzle, the condenser being mounted on flexible columns to allow for movement with changes in temperature.

It is of the two-pass type, having 5,400 sq.ft. of cooling surface contained in the 72-in. diameter, 19-ft. long steel shell. Tubes are of Admiralty metal, 1 in. diameter, No. 18BWG. It was selected to maintain 2 in. absolute back pressure on the turbine exhaust under full load when supplied with 7,200 g.p.m. of 80-deg. F. cooling water.

Air removal equipment is of the twin, two-stage type, with one-half the twin unit proportioned to remove air and non-condensible vapors during normal operation, the other half a spare. Separate, surface-type inter and after coolers are provided to insure against leakage between stages and provide uninterrupted operation.

Two condensate pumps are 6x3-in., two-stage, each driven by a constant speed induction motor. Through the use of a double-suction first-stage impeller, placed between the two single-suction second-stage impellers, the pump is hydraulically balanced under all loads and the glands are always under positive pressure from the discharge of the second stage.

Circulating water is provided by a pump placed between, and driven by either of, two constant-speed motors, at 690 or 585 r.p.m. Four Griscom-Russel vertical feedwater heaters, grouped in pairs and arranged with automatic valves by-passing two units at a time, are employed to deliver boiler water after passing through stage heaters at 425 deg. F. Two boiler feedwater pumps operate independently or in parallel, each driven by a single, 200-hp. motor. Each consists of two 4-3-in., four-stage pumps, connected in series to deliver 150 g.p.m. against a 2,400-ft. total head. Temperature of water leaving the pumps is less than 150 deg.

Boiler Water—Supply to the boiler is from a well with water hardness of 15 grains per gal. First treatment is through a Lakeside Zeolite softener, then through a Griscom-Russel evaporator, vapor being condensed in the first-stage bleed heater. Excess makeup is by-passed automatically to a high-level reservoir. Steam input to the evaporator is controlled by the level of water in the elevated tank.

The cooling tower, at the nearest point located about 40 ft. from the outer corner of the boiler, is a Marley, forced-draft, with five 20-hp., two-speed fans, each running a maximum capacity of 9,000 cu.ft. per minute. Water capacity of the tower is 5,000 g.p.m. Dimensions of this unit are 26x70x30 ft. high. It has two horizontal water spray headers. The Marley tower is supplemented by an existing 3,000-g.p.m. Braun atmospheric tower.

Circulating water makeup comes from the softener and all circulating water is treated for algæ by adding free chlorine through a Wallace & Tiernan Company dispenser.

Boiler water level control is a Bailey fluid type, operating on a diaphragm motor valve, following a constant pressure regulating valve.

Controls—A single operator, stationed at a central control, handles the boiler and turbine unit panel (Fig. 3), furnished by General Electric Company, and equipped with Bailey meters and Ashcroft gages. From this point all auxiliaries and turbine output can be governed by remote control, ammeters and pilot lights indicating auxiliaries in operation.

Electrical Equipment—Main contact switches are General Electric, air-break, 440-volt. All auxiliaries can be energized from either the turbine auxiliary transformer or the house auxiliary bank, through mechanically interlocked switches controlled on the main board.

Synchronizing is taken care of by the operator of the main switchboard. This has a dual control in conjunction with the turbine board. The main generator switch, supplied by the General Electric Company, is interlocked electrically through the direct-connected exciter and an auxiliary house exciter.

Current differential protection on each phase of the generator is interlocked with the exciter and main circuit breaker switches, and the machine is automatically unloaded in case of a ground within the unit.

Performance highly satisfactory

In operation since summer, the unit has turned in a highly satisfactory performance. Exceptionally good turbine balance plus complete inclosure of the machine have resulted in quiet operation. This is a big factor, the plant being located in a residential section, where quiet operation has an important bearing on the keeping of public good will.

Structure Insulated to

Reliability of Existing Substation Enhanced by Sectionalization, Double Bus Tie Breakers, Insulation From Ground of Structure and Equipment

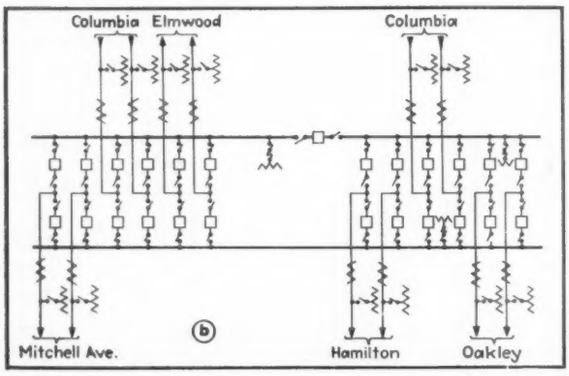
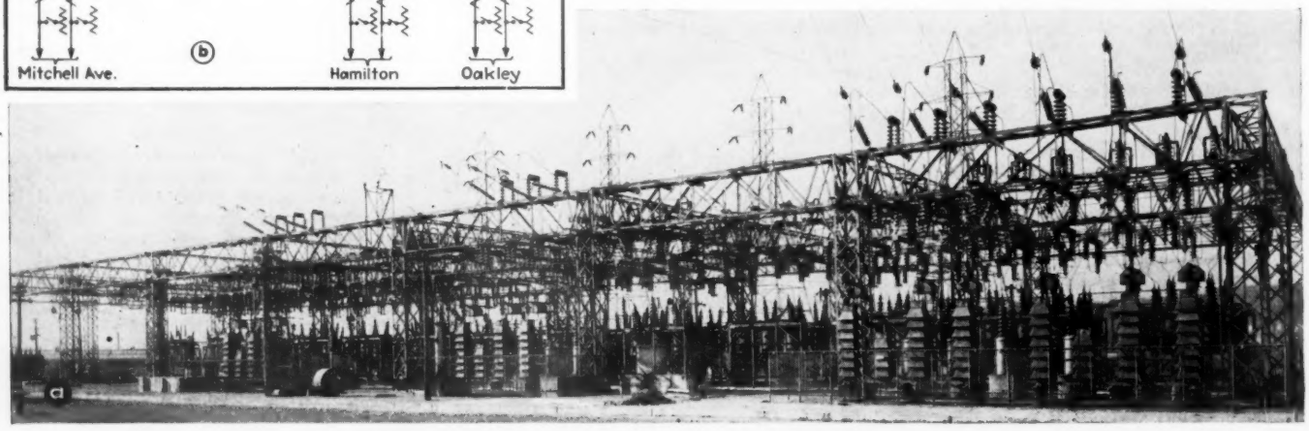


Fig. 1 — Bulk power transfer function performed by 66-kv. Hartwell switching station

(a) Ties main generating stations in Cincinnati area together and also effects 66-kv. interconnection with Dayton Power & Light Company system.
(b) Originally Hartwell was a single large substation as shown. The station connections incorporated a main bus sectionalized at one point by a single oil circuit breaker, a reserve bus continuous throughout the station and all circuits equipped for dual operation. The steel supporting structure was of the latticed box column and beam design and continuous. The layout has been changed to that shown in Fig. 2 (a and b).

SYSTEM connections were such that bus faults occurring in the Hartwell station switching structure (Fig. 1) when cleared would result in the separation of Columbia power station from the system load. The portion of the system load normally carried by Columbia power station made it necessary to dump load under separation conditions before reconnection to the system could be established. Also, faults occurring on the circuits connected to Hartwell station buses and on the buses themselves could result in instability between the various generating stations on the Cin-



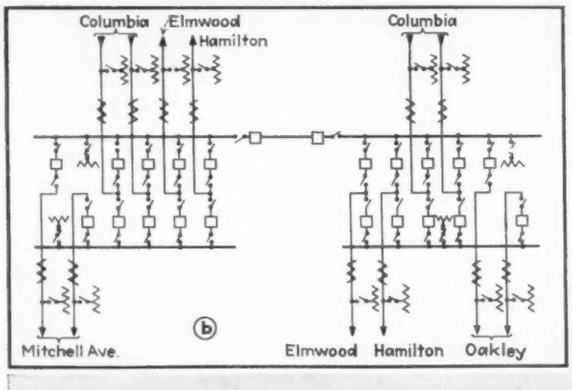
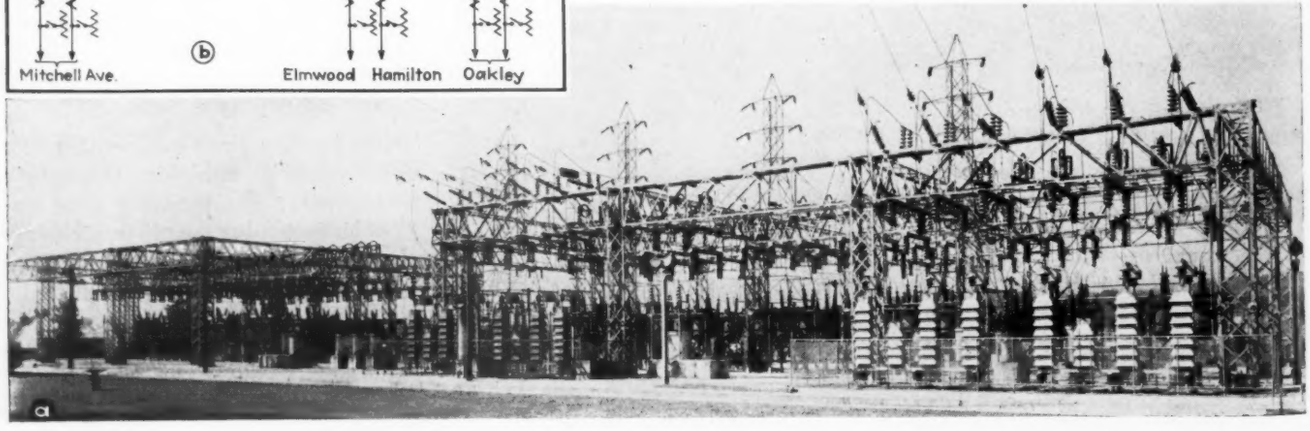


Fig. 2—Hartwell now affords two separate transmission channels between Columbia power station and other generating stations on system and to load connected between them

(a) Physical separation provided. (b) Double bus tie breakers introduced as shown here and in Fig. 4.



Isolate Ground Faults

By G. E. HEIDENREICH
Assistant Electrical Engineer Cincinnati Gas & Electric Company

cinnati and Dayton systems. In order to guard against this condition of instability it became necessary to limit the output of Columbia power station.

As a solution to these problems of separation and instability Hartwell station was divided into two physically separated substations with facilities to tie together the two sections of main bus through double bus tie breakers. The physical separation (Fig. 2a) was sufficient to insure that arcing in one section of the station would not be communicated to the other. By proper distribution of circuits on the two sections of the station two separate transmission channels, in effect, were formed between Columbia power station and the other generating stations on the system and to the load connected between them. Both sections of the station were rebuilt to include the application of ground fault bus protection.

In order to insure reliable operation of the ground fault protective scheme adequate insulation had to be provided between ground and all items of equipment as well as all sections of the supporting structures. Study of the various insulating materials available resulted in the selection of porcelain because of its resistance to weathering, definite dielectric characteristics and long life. This insulation was designed for approximately 2,000 volts working pressure. Insulation was installed in locations as follows:

1. A special porcelain unit, complete with its steel mountings, was placed in each of the four vertical angles (Fig. 3a) on all columns. The mountings were designed in such a way that the unit could be inserted in the vertical angle and would fit the drilling on these angles and the

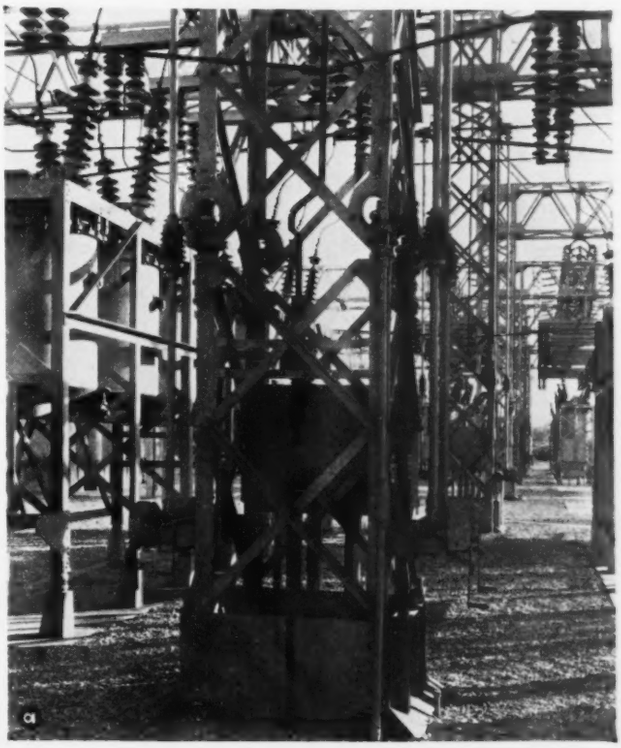
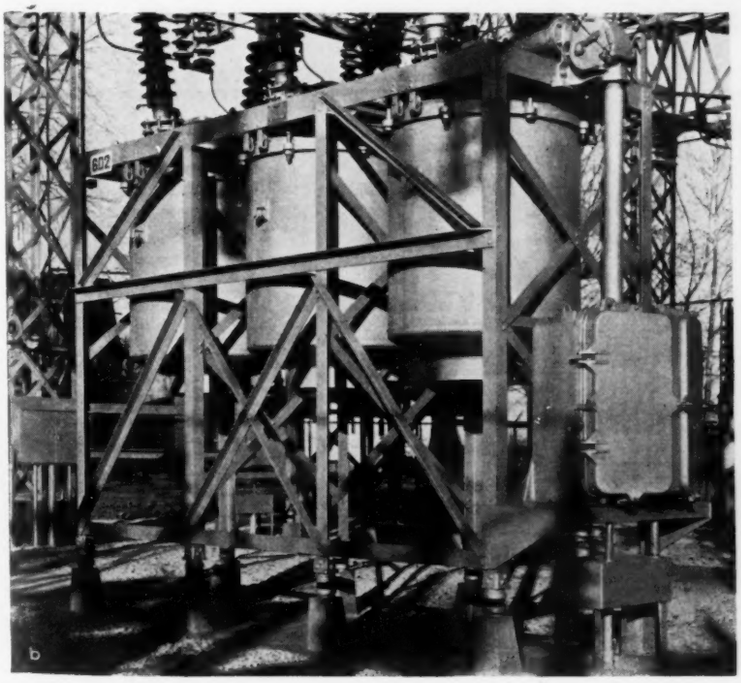
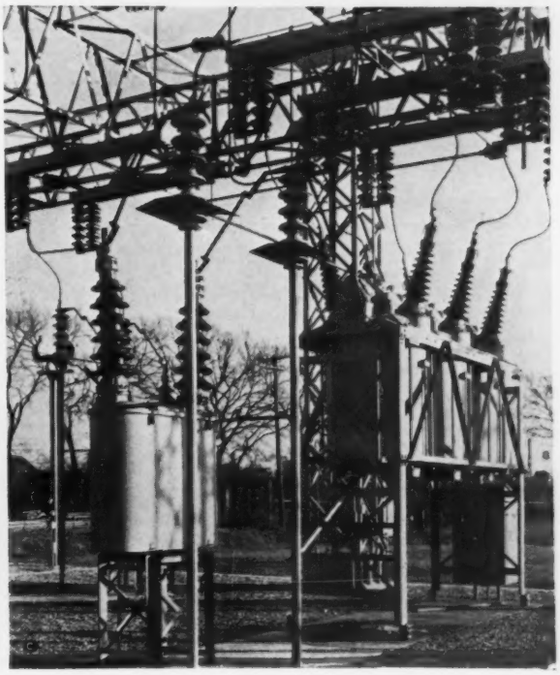


Fig. 3—Porcelain insulators inserted between ground and all items of equipment as well as sections of bus structure

(a) Typical introduction of insulators into structure columns, in this instance at fault bus current transformer location.
(b) Oil circuit breaker structures also insulated from ground.
(c) Bus potential transformers protected up to fuse by special bus support with flashplate assembly.





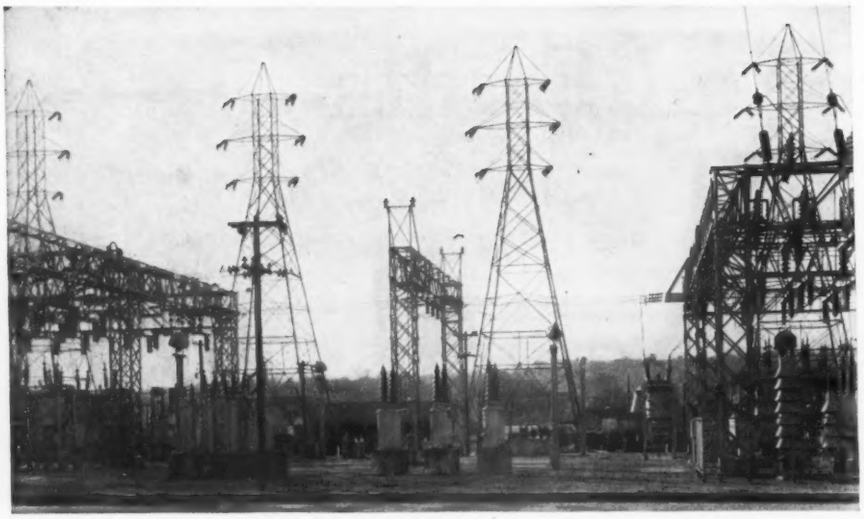


Fig. 4—Station sections isolated and bus ties inserted in this section

cross bracing. Templates permitted accurate drilling of additional holes required. Only one leg of each column was cut at one time, thereby insuring sufficient strength in the entire switching structure at all times and permitting installation of all insulating units in the columns without removing the station from service.

2. Porcelain spool sections were inserted under the vertical legs of oil circuit breaker supporting structures (Fig. 3b).

3. Insulating sections were installed in control conduits below the oil circuit breaker control mechanism inclosures, and control cables without metallic covering were used.

4. Porcelain insulating sections were inserted in the vertical operating rods (Fig. 3a) of all disconnecting switch mechanisms.

5. Porcelain insulating sections were inserted in control conduits to the 66-kv. current transformers and lead-covered control cable was replaced with cable having no metallic covering.

6. A special bus support with flashplate assembly (Fig. 3c) was installed in the 66-kv. connections to bus potential transformers to protect these connections up to the fuse installation.

7. All lighting was removed from the switching structures and installed on separate standards.

8. Grounding blades were removed from all lightning arrester disconnecting switches.

The various items of porcelain insulation and the manner of installing them are shown in the accompanying illustrations. The porcelain units were designed and furnished by the Lapp Insulator Company.

In order to provide a definite, low-resistance connection from all parts of each switching tower to the ground fault current transformers a copper bar network was installed throughout the upper sections.

The ground fault connections in each of the two separate switching towers are tied to the station grounding system through 400/5-amp., 15-kv. outdoor type current transformers. The separate supporting structure in the tie connection between the two sections of the station is similarly connected to ground through a third current transformer.

A ground fault occurring in either of the two sections of the station operates to open all breakers connected to that section, including both tie section breakers. A ground fault in the tie section structure operates to open both tie section breakers only. Sufficient relays are used so that no more than four breaker trip circuits are handled by any one relay.

A similar protective scheme has been incorporated in the new Front Street substation, which has just been completed and placed in service, the insulation locations and design being similar to those used at Hartwell station.

Considerable thought is being given to the matter of satisfactory and safe periodic testing of the ground fault connections of these stations. Similar protective schemes on indoor, lower voltage installations are being satisfactorily tested by disconnecting the fault bus system from ground and checking the insulation resistance, the tester being protected by a low-resistance film between the disconnected points. In the high-voltage outdoor stations, due to possible accumulation of static charges, it would not seem desirable to disconnect the fault bus system from ground. On this account consideration is now being given to testing by means of a circulating current and checking the input current against that flowing out of the fault bus network through the fault bus current transformer.

270,303 Isolated Farm Lighting Plants

According to a tabulation compiled by the Electrical Division, Bureau of Foreign and Domestic Commerce, there were 270,303 self-contained lighting plants on farms in 1930. These are the latest available statistics. The number by states, listed below, was computed from the Report on Agriculture, Fifteenth Census, for that year by subtracting the number of farms purchasing electricity from the total number that are electrically lighted.

By way of comparison, reference may be made to a recent report of the Edison Electric Institute giving the number of farm customers of electric light and power companies at the end of 1936 as 1,042,924.

New England	8,133	Michigan	10,552	West Virginia	2,786	**Mountain**	10,013
Maine	1,982	Wisconsin	16,332	North Carolina	6,237	Montana	1,564
New Hampshire	1,176	**W. North Central**	71,876	South Carolina	3,028	Idaho	2,078
Vermont	1,162	Minnesota	10,9[illegible]	Georgia	3,998	Wyoming	691
Massachusetts	2,216	Iowa	21,8[illegible]3	Florida	2,358	Colorado	2,845
Rhode Island	279	Missouri	7,737	**E. South Central**	13,176	New Mexico	589
Connecticut	1,387	North Dakota	4,471	Kentucky	4,828	Arizona	601
Middle Atlantic	26,565	South Dakota	6,536	Tennessee	3,290	Utah	1,316
New York	11,669	Nebraska	13,895	Alabama	2,620	Nevada	329
New Jersey	2,[illegible]73	Kansas	10,415	Mississippi	2,438	**Pacific**	15,468
Pennsylvania	12,[illegible]23	**South Atlantic**	26,757	**W. South Central**	21,706	Washington	4,986
E. North Central	73,6[illegible]9	Delaware	534	Arkansas	2,432	Oregon	3,406
Ohio	13,[illegible]45	Maryland	2,915	Louisiana	2,225	California	7,076
Indiana	11,766	District of Columbia	[illegible]7	Oklahoma	4,149		
Illinois	15,914	Virginia	5,279	Texas	12,900	**Total U. S.**	270,303

Better Protection for High-Voltage Motors

By J. FRED LINCKS
Cutout Engineering Department, General Electric Company, Pittsfield, Mass.

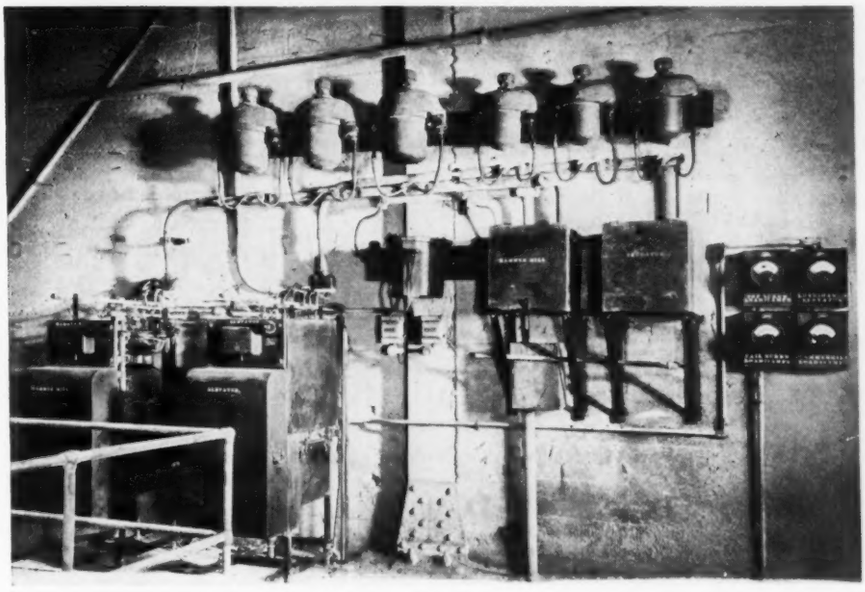


Fig. 1—Oil fuse cutouts afford short-circuit protection

Installation of 200- and 300-amp., 2,500-volt D & W oil fuse cutouts protect 250-hp., 2,200-volt automatic compensator and motor of West Penn Cement Company, Pittsburgh.

IMPROVED control and protection on 2,300-volt and higher voltage motor installations with possible savings in both initial and maintenance costs should prove attractive to all those having or contemplating the use of such equipment. The value of oil fuse cutouts as short-circuit "back-up" protection to motors and control equipment in both large and small industrial plants (Fig. 1) has been proved in service. In addition to the accruing benefits affecting safety, initial cost and maintenance, installations can be made which fully meet the National Electrical Code.

Modern standard control equipment performs a real service in protecting the motor, lines and other connected equipment against the detrimental effect of overcurrent, full voltage restarting under load, overheating, and so forth. It is designed for repeated opening and closing of the circuit, as required in industrial service. To meet this requisite economically, the contacts and other moving parts are much lighter than would be necessary in a device capable of interrupting high short-circuit currents, thereby resulting in lower initial and maintenance expense. With such control equipment, the magnetic opening of the contact fingers against the spring pressure occurs at varying magnitudes of short-circuit currents, depending upon the rating and thus the cost of the equipment. When such an opening occurs the ensuing arc in the oil creates explosive gas pressure on the containing walls, burns the contacts and tends to freeze them closed, especially if they chatter. Naturally the degree of damage caused thereby is a function both of the magnitude of the current and of the time it is permitted to flow by the other protective equipment in the circuit. It is, of course, unsafe to permit the contactor to attempt to clear high short-circuit currents.

Where it is impractical to limit the current to a value which can be successfully handled by the less costly types of control equipment, larger, more costly controllers or oil circuit breakers are used. The higher resultant cost is naturally a result of the degree of interrupting duty demanded of them. Attempts are made to limit this operating duty by arranging the controller or breaker so that it will not open under high short-circuit currents and by depending upon the main circuit breaker to clear these heavy currents. Severe faults with such an arrangement naturally cause a major shutdown of the entire system and all connected equipment.

Back-up omission constitutes gambling

In operating practice there is some tendency to gamble with the probability of short circuits occurring at a particular installation by omitting the "back-up" protection and then accepting the consequences when faults

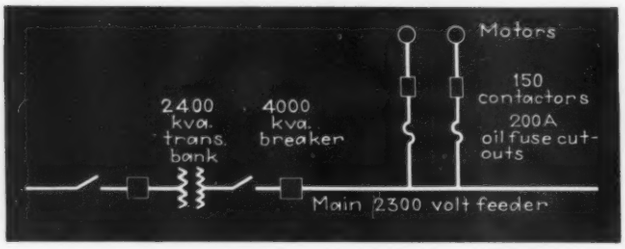


Fig. 2—Use of contactors on high capacity circuits made safer and cheaper by the use of oil fuse cutouts

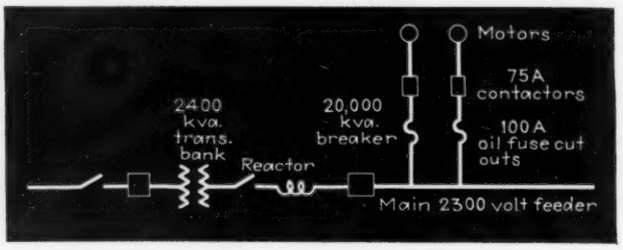


Fig. 3—Added reactor can pay for itself—May permit safe use of contactor on high capacity circuit or smaller and less costly breakers, contactors and cutouts

do occur. Where experience has dictated the need for better short-circuit protection for the control equipment and motors various methods have been employed as a means of either controlling the magnitude of current, the time of current flow, or both.

In some cases controllers are employed for repeatedly opening and closing the circuit and other protective devices are installed for short-circuit "back-up" protection. The degree of protection afforded with such an installation is a function of the speed of opening of the circuit by the protective device. One having an inverse time current characteristic similar to the heating or burning of the copper in the motor, the lines or the control equipment will afford the best protection. Where interlocking of several motors is not required, such slower operation at low currents and very fast clearing of the circuit at high currents, as is provided by fuses, makes them ideal for short-circuit back-up protection.

Fuses will afford protection against much higher short-circuit currents than devices without the inverse time current characteristics, since at these higher currents the fuses will clear the circuit in one-half cycle, or even less in some cases. The recognition of these facts has led a growing number of industrial concerns to employ fuses as "back-up" protection for their 2,300—or higher—voltage control equipment and motors, thereby permitting them to install lower-rated and less expensive control equipment and at the same time secure improved protection.

For example, on a feeder circuit as shown in Fig. 2, where the three-phase short-circuit capacity is 40,000 kva. or 10 000 amp. at 2,300 volts, the use of oil fuse cutouts permits the installation of a medium-priced contactor. Without these cutouts a more costly controller or circuit breaker would have to be substituted for the contactor to secure equivalent protection with respect to the safe operation of the control device without being damaged in clearing short circuits. However, burning at the fault and the stress on connected equipment would be considerably higher, depending on the length of time required to clear the circuit in excess of the one-half cycle required by the fuse cutout.

If, however, the available power at the point of installation is limited to 20,000 kva., 5,000 amp. at 2,300 volts, either by the source of supply or by the line impedance or by an installed reactor (Fig. 3), a smaller 75-amp. contactor and, many times, a lower-rated fuse cutout can be employed, effecting a material saving in initial cost. The 10 000- and 5,000-amp. interrupting ratings of the available oil fuse cutouts line up with the respective safe short time current carrying ability of the respective medium- and low-priced control equipment, thus making an ideal combination.

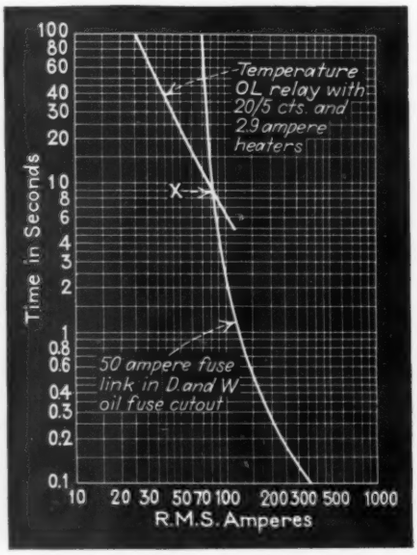


Fig. 4 — Fuse backs up relay protection

Curves show relation of relay on contactor and fuse link time-current characteristics for proper co-ordination in protecting 40-hp., 2,300-volt motor. Relay opens all currents up to point X (where curves cross), then fuse clears the circuit.

Reactor gives lower cost and stresses under fault conditions

The use of reactors, as shown in Fig. 3, to limit the current to 10,000 amp. or less not only permits lower-cost control and protective equipment but also greatly reduces the stress upon connected apparatus with an attendant improvement in safety. It is readily apparent that since the arc gas generated is a function of the arc energy ($KEIt$), the reduction of the current I will decrease the stresses on the housing of the apparatus in which the fault occurs. Thus the insertion of a reactor in the main feeder circuit may make possible safer, improved protection at lower cost for all installations of protective equipment and industrial apparatus on the system. Of course, the limit of reactance which can be installed on any circuit must be governed by its effect on the operation of synchronous motors, as well as the economics involved.

In appying fuses for the protection of motor and control equipment, consideration must be given to the time-current characteristics of the fuses as they are related to the overload relays or releases on the contactor. The relation should be such that the contactor is permitted to open all normal overload currents up to those approaching its interrupting ability, and then the fuses should clear all currents in excess of this value before the tripping of the overcurrent device on the contactor (Fig. 4).

For the oil fuse cutouts and contactors tested the best results will be secured with a fusing practice in which the rating of the fuse links installed in the fuse cutouts is four times the full load current of the

[*Continued on page 134*]

Better Test Results From New Meter Boards

Socket Meter Testing Expedited by New Design of Test Board—Standardization Board Affords Widely Diversified Availability

By CARL C. ESTES
Meter Superintendent, Salem Electric Lighting Company, Salem, Mass.

TWO new test boards have recently been designed and constructed by the meter department of the Salem Electric Lighting Company. One facilitates the testing of "S" type meters and the other is a standardization board. Advantages obtained from using the test board are consistent results on standard test meter calibrations, along with reliable and convenient checking of portable and graphic instruments. Time for making complete tests and calibrations has been reduced by 50 per cent in comparison with the old method used.

The "S" type meter test board is very compact and has an attractive appearance, as can be seen from Fig. 1; the wiring is shown in Fig. 2. The test board is arranged for testing "S" type meters primarily, but bottom-connected meters can also be tested. Meters can be tested one at a time or three in series.

Ring sockets set in panel

The board is supplied from 230-volt, three-phase source through a phase shifter which gives 230 volts single phase for the test circuits. A voltage regulator gives 11 volts regulation. Current is obtained from a loading transformer with resistances for $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 2, 5, 10, 20, 20, 50, 50 amp., with a rheostat on the 1-amp. step. Current steps are split between the 2-amp. steps and arranged for a light and full load switch for the standard test meter. Potential for the meters under test is supplied by three potential transformers, 230 volts to 115/230 volts.

Standard ring type sockets with binding posts removed are set into the panel and copper bus brought into the switch jaws. A spring potential terminal is mounted on a bakelite plate for testing three-wire and polyphase meters.

Two- and three-wire meters can be tested in all three sockets, but polyphase meters only in No. 3 socket. An extra switch jaw is mounted on the lower terminal block in this socket to supply common potential to a polyphase meter.

Each testing position and standard

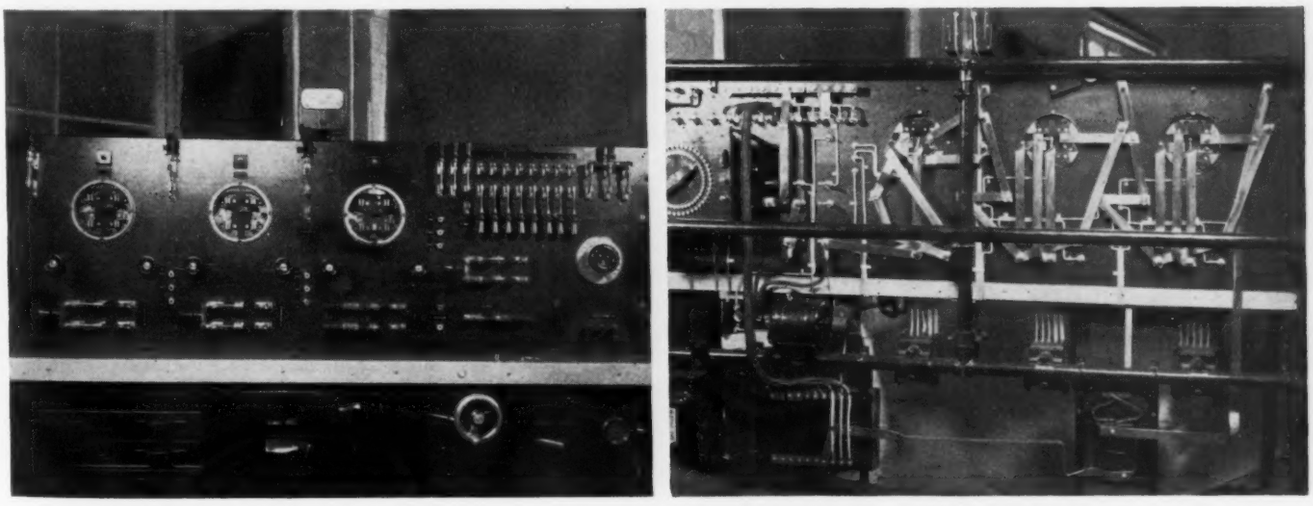


Fig. 1—Meter test board halves the time for testing S meters and it also handles bottom-connected meters
Left—Front of board shows compactness and trimness.
Right—Rear of board with current control at left, meter connections at right.

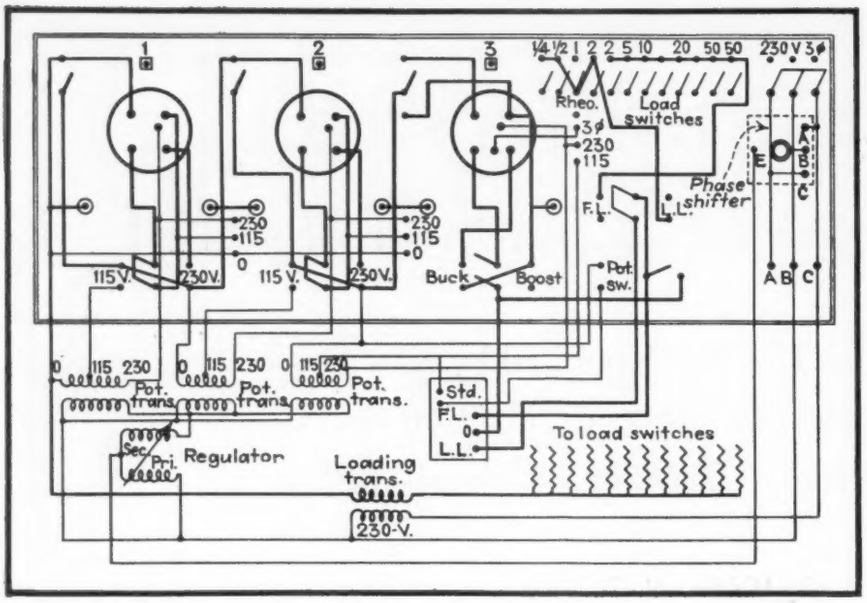


Fig. 2—Three locations for single-phase meters with one (No. 3) also for polyphase meters

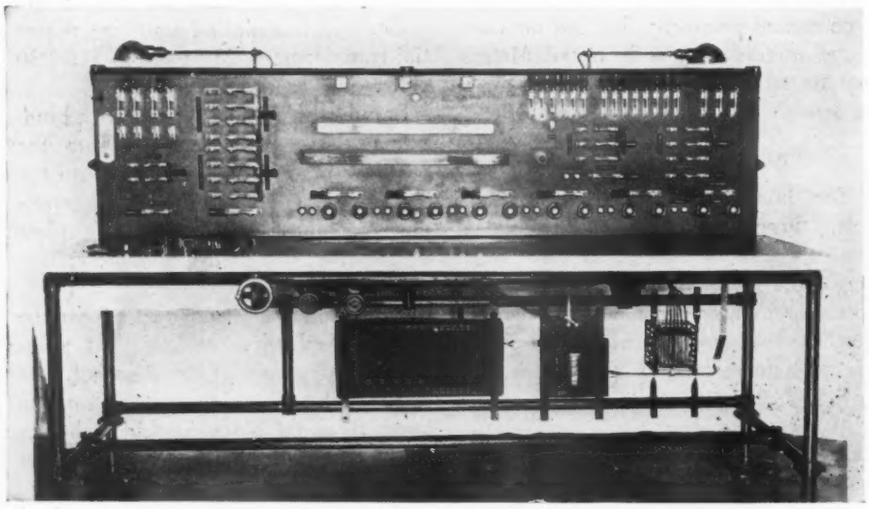


Fig. 3—Standardizing board provides six meter locations for portables, graphic instruments, transformers, etc.

meter has a current switch which shunts out the socket if it is not to be used. Also, each position has a voltage selector switch for 115 or 230 volts. In addition, the No. 3 position has a single-pole, double-throw switch, so a polyphase meter can be tested single element and two single-pole, double-throw switches arranged for buck or boost test with the current coils in series. The proper voltage for a polyphase meter is obtained by using a small jumper from the 115- or 230-volt to three-phase plug terminal to the right of the No. 3 socket.

Each testing station is supplied with a hanger screw for bottom-connected meters and current binding posts and potential plug terminals from which leads can be connected to the terminals of the meter. The meters hang over the sockets and a blank plate is used to cover up the socket.

A voltmeter, 150-volt switchboard type, is mounted on a bracket over the board. There is a set of metal drawers under the table top for leads, tools and small meter parts. The standard meter is set in a well in the table top and wired in permanently.

The test board is constructed of 1¼-in. pipe framework, ebony asbestos panel 6 ft. 2 in. x 2 ft. x 1 in. and a table top 6 ft. 6 in. x 20 in. x 2 in., covered with green battleship linoleum edged with birch.

This test board has provided ample testing facilities for testing all the type "S" meters used by the Salem company and has been very convenient, reliable, fast and safe.

Standardizing board also devised

The standardization test board (Fig. 3) was conceived because of the necessity for reliable testing facilities for standard test meters, portable and graphic instruments and split-core transformer testing sets. Also, it provides a means for making special tests on watt-hour and demand meters.

Voltage to the board is 115/230, single phase, with a 20 per cent regulator and a selector switch so either regulated or unregulated voltage can be used. The potential circuit is taken from an auto-wound potential transformer. Current is obtained from resistance load for the ¼, ½, 1, 2, 2, 5-amp. steps with a rheostat on the 1-amp. step and from a loading transformer for the 5, 10, 20, 20, 50, 50, 50-amp. steps with a rheostat on the 5-amp. step. Either one type of load or the other is obtained through a selector switch.

There are six testing positions with current binding posts and potential plug terminals at each station and a current shunt switch at each station.

Set in a well in the table top on the left-hand side are the calibrating standards. These consist of a voltmeter, 150/300 volts; an ammeter, 5/10 amp.; a wattmeter, 5/10 amp., 150/300 volts, and a standard test meter 1-5-10-50-100 amp., 115/230 volts.

The control circuit for the instruments has been arranged so they can be used for the full current capacity of the board. There is a throwover switch which puts a current of 10 amp. or less direct through the instruments on one side and 200 A or less on the other side. Current is limited to the instruments by two double primary current transformers 25/50 amp. and 100/200 amp. to 5 amp. Selector switches are provided in the primary of the current transformers for the current value desired.

The board is constructed of 1¼-in. pipe framework, ebony asbestos panel 8 x 2 ft. x 1 in., table top 8 ft. 4 in. x 26 x 2 in. made of tongue-and-groove core covered with battleship green linoleum with birch trim.

Much credit is due to Samuel A. Cushing for the designing and electrical construction with the assistance of William A. Hadley for his part in the assembling.

What They Said on TVA

INDICATIONS that the TVA is soft-pedaling the so-called "yardstick" rate, upon which the federal power agency was created by President Roosevelt and which was to set a standard as to the cost of electricity, is seen in the maneuvers made in the present eighteen-utility case before the court in Chattanooga, Tenn.

The TVA has blocked every move to introduce evidence of rates and the effect of subsidized competition with private utilities to force lower cost of electricity to customers. TVA Counsel Fitts has told the court that the government can give away TVA power if it wants to.

Observers declare that it is difficult to reconcile TVA's present move with its spoken intentions in the following:

Here, then, you have the clear picture of four great government power developments in the United States, the St. Lawrence River in the Northeast, Muscle Shoals in the Southeast, the Boulder Dam project in the Southwest, and, finally, but by no means the least of them, the Columbia River in the Northwest. Each of these will be forever a national yardstick to prevent extortion against the public and to encourage the wider use of that servant of the people—electricity.—FRANKLIN D. ROOSEVELT, *Portland, Ore., Sept. 21, 1932.*

The Tennessee Valley Authority Act marks the beginning of a new national power policy and national power program. This new national policy has two major objectives. The objective is more effective protection of the public interest, by the setting up of a measure of public operation of power as a *yardstick!* The second objective of this new national policy is a greatly increased use of electricity in the homes, the farms and the factories of the United States—an electrified America.

The power program of the Authority is a crucial part of its plans for immediate action and of the long-range program for the development of this region. This power program is of particular interest not only within the valley, but it has and is intended to have, a *national significance.*—LILIENTHAL, *Atlanta, November 10, 1933.*

Finally, in 1933, at President Roosevelt's suggestion, provision for the public ownership and operation of Muscle Shoals was incorporated in the Tennessee Valley Authority law. This provision may make possible the carrying out of one of President Roosevelt's policies, that of providing a publicly owned and operated power system as a "yardstick" by which to measure the relative economy and efficiency of public and private ownership and operation.—A. E. MORGAN, *December 6, 1933.*

The "yardstick" is to be applied to problems of the country's resources in order to determine more definitely the public's obligation to them and their place in a national policy of economic and social planning.—H. A. MORGAN, *Chattanooga, February 6, 1934.*

But on the other hand, the very fact that a community can, by vote of the electorate, create a yardstick of its own will, in most cases, guarantee good service and low rates to its population. I might call the right of the people to own and operate their own utility a "birch rod in the cupboard, to be taken out and used only when the child gets beyond the point where mere scolding does any good."—A. E. MORGAN, *March, 1934.*

The power program of the Authority is an integral part of a larger policy for the economic development of the United States. LILIENTHAL, *Boston, April 24, 1934.*

Mammoth power plants, with intricate generators large enough to supply whole cities, are being erected beside the dams; land is being cleared for huge reservoirs, and thick transmission lines are being strung up to carry to home and factory the low-cost electricity that is to come. This activity is only the beginning of a national plan to increase the supply of electric power and to bring down its cost.

These "yardsticks" provided by both municipal and federal enterprises are so valuable that they alone would warrant PWA's expenditures for power undertakings. The municipal projects have caused private utilities to adjust their rates downward in wide areas and the federal projects have brought about rate adjustments over still larger expanses of territory.—ICKES, *June, 1935.*

To make the area a workable one and a fair measure of public ownership it should include several cities of substantial size (such as Chattanooga and Knoxville) and, ultimately, at least one city of more than a quarter million, within transmission distance, such as Birmingham, Memphis, Atlanta or Louisville.—T.V.A. PRESS RELEASE, *August 25, 1933.*

What the Tennessee Valley Authority is required to do in its power program is to set up an area for power operations. That area is to be on a comparable basis with typical private operations. To set up such a "yardstick" the Authority obviously must undertake to serve an area which is large enough and sufficiently concentrated, and with an adequately diversified industrial, commercial and residential load to provide a fair test. As business men, it is apparent to you that if the Authority is to serve only the parts of a territory which a private utility has not chosen to serve, or is to serve only sparsely populated areas, the result of our operations cannot possibly be set up as a measuring rod.—LILIENTHAL, *Atlanta, November 10, 1933.*

The act definitely puts the federal government into the business of rendering electric service.—LILIENTHAL, *Philadelphia, January 5, 1934.*

Drastically lower rates for electric service is the first step toward a wider use of electricity. The Tennessee Valley Authority is proceeding to put such substantially lower rates into effect in the area in which it is to distribute Muscle Shoals electricity.—TVA—LILIENTHAL, *Washington, D. C., January 20, 1934.*

We are making provision for one of the largest hydro-electric developments in the world, with a potential three million horse power available.—LILIENTHAL, *Chattanooga, April 21, 1934.*

SENATOR DICKINSON—Well now, in connection with these dams, the entire purpose is the production of electrical energy?

DR. MORGAN—That is the major purpose.—A. E. MORGAN, *June 13, 1934.*

I want to emphasize that the Tennessee Valley project was not an emergency measure; it was not to be merely an unemployment relief measure.

. . . we were directed to transform the wasted water power of the Tennessee River into electricity and to distribute that electricity at fair rates so it could be used in the humblest home and the isolated farm.—LILIENTHAL, *Detroit, September 2, 1935.*

The power policy written into the Tennessee Valley Authority Act represents an attempt to regulate public utilities not by quasi-judicial commissions, but by competition. The act definitely puts the federal government into the business of rendering electric service. The Authority is required to acquire a market and to set up an area in which to conduct its operations. The results of these operations in this limited area are intended to serve as a "yardstick" by which to measure the fairness of the rates of private utilities, and to prevent destructive financial practices by the latter.

In carrying out this competitive relation between the federal government and the private business of electricity, the wastes of competition are to be eliminated and the regulatory function of competition emphasized.—LILIENTHAL, *March, 1934.*

Fuse Primaries Even When Using Reclosers

By H. B. PHELPS
Engineering Department, New York Power & Light Corporation, Albany

SHOULD overhead distributed primary feeders be fused when the feeder circuit breakers are reclosed after tripouts, either manually (at an attended station) or by automatic reclosing equipment? In the absence of any definite reclosing schedule, it would be good practice to install primary fuses at every strategic location, in so far as the fuse sizes could be co-ordinated with each other and with the circuit breaker. This would give the best possible service to all customers, by limiting interruptions to the smallest possible area.

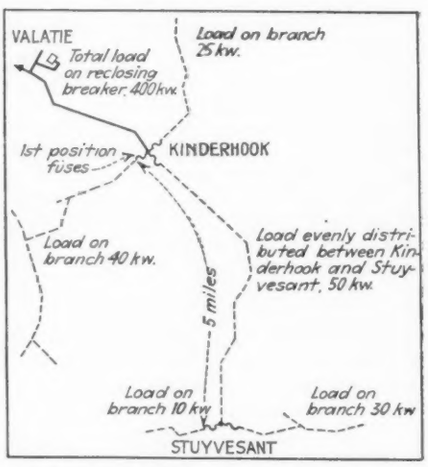
This picture is changed by the use of a reclosing schedule, because a fuse may interfere with the restoration of service after temporary line faults. It is probable that at least a majority of the faults which occur on overhead lines are of a temporary nature and can be cleared by opening the circuit and immediately reclosing. For the best service on any particular branch, the branch should be connected solidly to the reclosing breaker, so that temporary faults will cause only a momentary instead of the sustained outage which follows a blown fuse. On the other hand, the solid connection is a hazard to service as far as the remainder of the feeder is concerned, because a permanent fault on the branch will cause the breaker to lock out and interrupt service on the entire feeder. Therefore, the questions of whether or not to fuse any particular branch, and where to fuse it, must be decided from the point of view of service on the feeder as a whole.

In order to evaluate service interruptions, it is suggested that the unit, "kilowatt-minute-outage" be employed. It is believed that this unit will be found more appropriate than the unit "consumer-minute outage." In the first place, it is fairer to the customer, since large consumers are properly weighted. Secondly, it is more adaptable to practical use, since kilowatt loads on the various parts of a circuit are known or easily determined. The ideal location for a branch fuse may then be defined as that which causes the summation of kilowatt minute outages on the entire feeder to be a minimum.

Derivation of a fuse locator formula

It may be shown that this ideal location depends on only two factors—the load distribution and the ratio of temporary faults to the total number of faults. These factors may be expressed in the following terms:

P = Total kw. load on reclosing breaker.


VALATIE
Total load on reclosing breaker 400 kw.
Load on branch 25 kw.
1st position fuses
KINDERHOOK
Load on branch 40 kw.
Load evenly distributed between Kinderhook and Stuyvesant, 50 kw.
5 miles
Load on branch 10 kw.
Load on branch 30 kw.
STUYVESANT

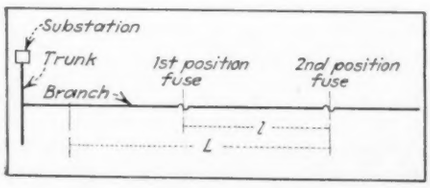
Fused locator formula demonstrates its value

In this example "P" is the total load on the branches out of Stuyvesant. This is not because the branches are fused, but is because the load is concentrated as far as section "L" is concerned, and its inclusion with the 50-kw. distributed load would result in a fictitiously high value for "λ." Also, the location of P' load is not confined to the end of section "L," but may be at any point beyond the first position fuse.

λ = Load density in kw. per mile along the section of line in which the fuse is to be located.

P' = Any concentrated load, not included in λ beyond the proposed fuse.

K = Ratio of temporary faults to total number of faults.



For demonstration, the following additional items may be introduced:

L = Total length of the sections considered. This section may start at any arbitrarily chosen point, but must end at a second position fuse or the termination of the branch. This quantity is a constant.

l = The length of that portion of "L" beyond the proposed fuse. This is a variable quantity, depending on the location of the fuse.

F = The number of faults per year on any designated part of the circuit.

f = The number of faults per year per mile along the section considered.

Z = Kw. outages, sustained. This is proportional to kilowatt minimum outages, the proportionality factor being the average time required to restore service after a fuse operation or lock-out.

The total Z consists of the sum of *

Z_a = Kw. outages due to faults on the unfused part of the circuit, and

Z_b = Kw. outages due to faults beyond the proposed fuse.

Z_a = The product of the total load on the reclosing breaker, into the number of permanent faults on the unfused part of the circuit. Let F_1 = Number of faults per year on the unfused part of the circuit, excepting the section "L". Then,

$$Z_a = P\ (1 - K)\ [F_1 + f\ (L - l)]$$

Z_b = The product of the load beyond the proposed fuse, into the total number of faults beyond the fuse, or

$$Z_b = (P' + \lambda l)\ fl$$

$$Z = Z_a + Z_b = P\ (1 - K)\ F_1 + P\ (1 - K)\ fL - P\ (1 - K)\ fl + P'\ fl + \lambda f l^2$$

* Outages due to faults beyond other fuses are not considered, because the effect of such faults (*i. e.*, the extent or duration of the outage) is not affected by the location of the proposed fuse.

[*Continued on page 136*]

One Modernized Lighting Layout

NO CASE OF UNSHOD CHILDREN OF THE SHOEMAKER can be made out against Hygrade Sylvania Corporation's new radio tube factory in Salem, Mass. This prominent lamp maker turned its engineering department loose on the problem of specifying the right kind, amount and application of lighting facilities, and with results typified in these photographic shots in the spic-and-span shop lately completed in the Witch City.

(a) Main floor general lighting, 14 ft.-candles average, mounting height of units, about 11 ft. (floor to lamp). Room 400 x 80 ft., no interior columns, Holophane No. 685, spacing 10 x 20 ft. staggered. Initial lamps 300 watts, future size 500 watts per unit.

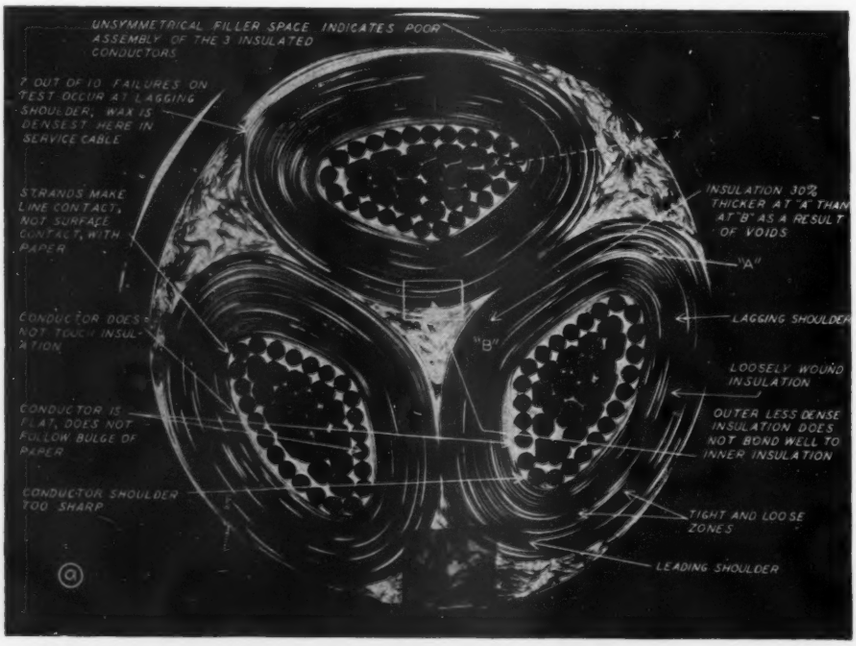
(b) Machine shop lighting at Hygrade plant averages 40 ft.-candles, the units being combination 400-watt high-intensity mercury-vapor lamps and 150-watt tungstens (one mercury and three incandescents per unit) with Wheeler glass-steel diffusers. Shadows virtually eliminated, unusually uniform intensity with considerable vertical component. Lamps are staggered on different phases of the three-phase distribution circuits used, in order to minimize stroboscopic effect of current pulsations on rapidly rotating machinery, the grinder, for example, running 3,450 r.p.m.

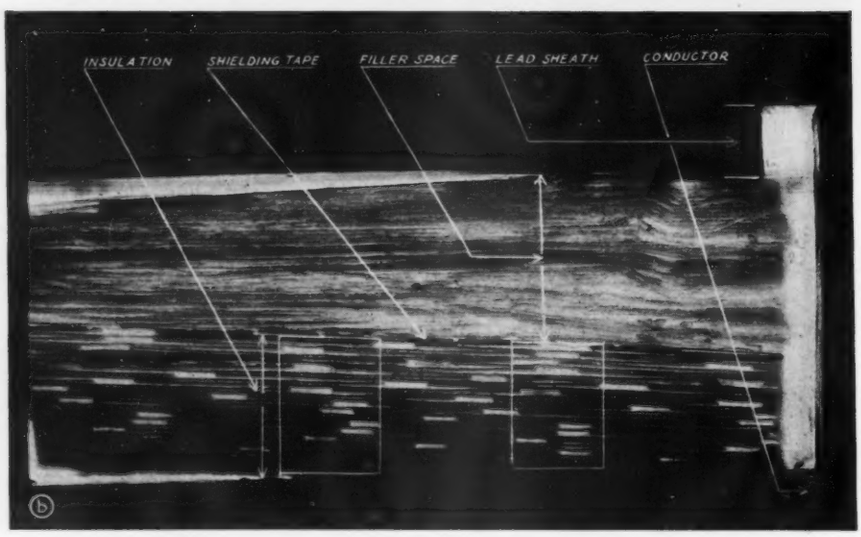
(c) Localized lighting of double 8-in. grinder, direct-driven, in machine shop. General illumination of shop ranges from 30 to 54 ft.-candles, but each wheel receives 125 ft.-candles, the equipment consisting of two 15-watt "home appliance" lamps per wheel, with shatter-proof glass. Starting the motor automatically turns on the lamps.

(d) Intensive localized lighting at spot welder delivers 120-ft. candles on work from 50-watt daylight lamp in shielded reflector without glare in operator's eyes, which are further protected by glass panel above welder points. General lighting from main units of room, 14 ft.-candles.

Microtomic Wafers Reveal

Thin Styrenated Sections Reveal the Degree of Physical Uniformity of Cable Insulation—Permits the Correlation of Electrical Stability With Uniformity of Mechanical Assembly


UNSYMMETRICAL FILLER SPACE INDICATES POOR ASSEMBLY OF THE 3 INSULATED CONDUCTORS
7 OUT OF 10 FAILURES ON TEST OCCUR AT LAGGING SHOULDER; WAX IS DENSEST HERE IN SERVICE CABLE
STRANDS MAKE LINE CONTACT, NOT SURFACE CONTACT, WITH PAPER
CONDUCTOR DOES NOT TOUCH INSULATION
CONDUCTOR IS FLAT, DOES NOT FOLLOW BULGE OF PAPER
CONDUCTOR SHOULDER TOO SHARP
INSULATION 30% THICKER AT "A" THAN AT "B" AS A RESULT OF VOIDS
"A"
"B"
LAGGING SHOULDER
LOOSELY WOUND INSULATION
OUTER LESS DENSE INSULATION DOES NOT BOND WELL TO INNER INSULATION
TIGHT AND LOOSE ZONES
LEADING SHOULDER
X
a



Enlarged portions of cable cross-sections reveal physical non-uniformities

(a) A styrenated wafer from 24-kv., three-conductor, H-type cable.

(b) A longitudinal section taken at the axis X-X of (a). At the areas marked by rectangles the superposition of butt spaces reduces the effective insulation thickness to only 65 per cent.

A QUANTITATIVE method for measuring the degree of mechanical uniformity of power cable insulation has been developed by the Detroit Edison Company which consists essentially of preparing a microtomic section of the cable being studied, thus revealing voids in the insulation that can then be measured by microscopic or photometric methods.

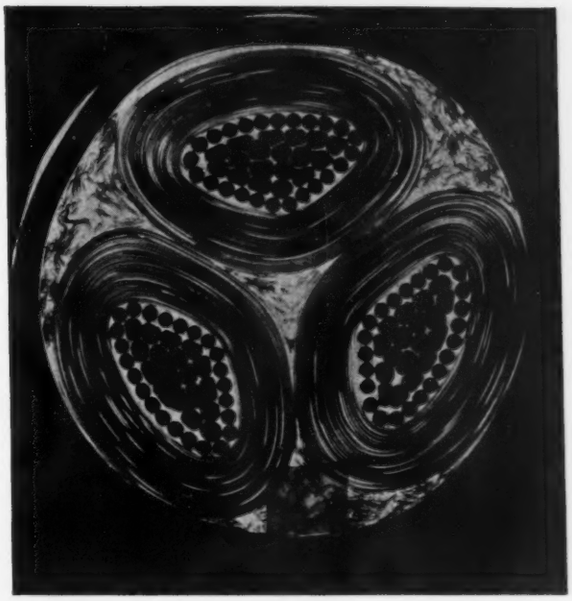
A 3-in. section is cut from the cable to be examined with a fine-tooth bandsaw and placed in an extraction can with the lower face supported 2 in. from the bottom of the can. Benzol is poured in to a depth of 1½ in. and the can covered with a lid provided with a spirally formed copper-tube condenser through which water circulates. Placed on a hot plate, the benzol drips on the cable cross-section. Extraction of the cable oil will be complete within one or two days. The oil-free sample is then heated in an oven at 100 deg. C. to dry out any benzol remaining in the paper.

Sample is styrenated

The dried cable is next styrenated. It is placed in a tin can about ½ in. larger in diameter than the cable and the cable is supported ¼ in. from the bottom of the can so no air is entrapped. The can is filled nearly to the top with 100 per cent pure liquid styrene and a lid with a small copper outlet tube soldered on. Placed in an oil or glycerine bath, the can is maintained at 125 deg. C. (caution: styrene is inflammable). For the first hour or so styrene vapor escapes through the outlet carrying air and entrapped gases, thus preventing for-

Cable Voids

By K. S. WYATT, D. L. SMART
and J. M. REYNAR
The Detroit Edison Company, Detroit, Mich.



mation of bubbles. The tube is sealed off after an hour. The can is removed from the oven after 60 to 80 hours, cooled and opened. A solid transparent styrene cylinder remains, in this cylinder is embedded the cable section.

Turned down in lathe

After sawing the 3-in. styrenated sample in two at about the middle, one of the sawed surfaces is turned down on a lathe until a smooth surface results. After the first face has been turned down a ½-in. section is sawed from this and styrenated as before, care being taken to see that the sawed face is at the bottom of the can. After polymerization the cylinder is placed in a lathe and the sawed face, now embedded in styrene, is turned down until it approaches within 5 or 10 mils of the end that was previously prepared.

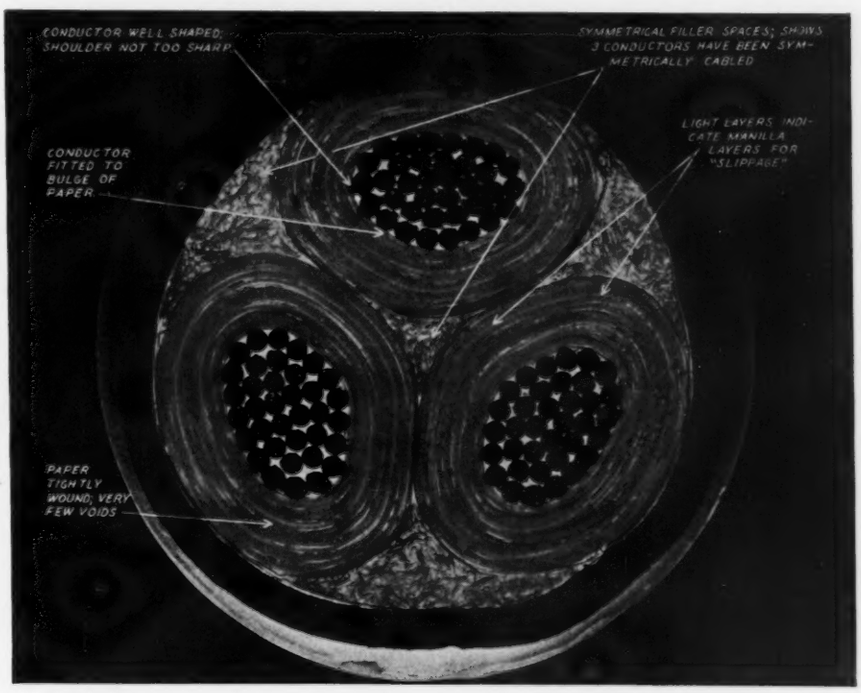
The styrene cylinder which has been used to hold the sample in the lathe may now be sawed off within ½ in. of the wafer and smoothed off in the lathe; it now serves as a backing to preserve the mechanical integrity of the wafer. If the section is now held up with the styrene backing facing a strong light the structure of the cable is beautifully revealed.

An alternative method of extraction and styrenation better adapted for work on a larger scale is to extract the oil and styrene-impregnate the insulation simultaneously with liquid styrene. Since the boiling point of styrene is above the temperature at which styrene polymerizes readily, this process must be carried out at greatly reduced pressures, which would involve more complicated apparatus.

Precise measurements of the spaces between layers of tape can be made and the thickness of the insulation around one conductor along different axes may be made with a traveling microscope. These measurements may be supplemented by the measurement of insulation and filler space areas with a planimeter.

A quantitative record in graph form of the irregularities along any axis may be obtained by making a contact negative of the wafer, and by then passing this negative through a densitometer.

As a result of this test method it is possible to show, in a cable made from oils and paper of normal characteristics and which has been normally dried and degassed, that electrical stability as indicated by ionization factor and behavior on heat cycle is a question of the degree of uniformity of mechanical assembly.


CONDUCTOR WELL SHAPED; SHOULDER NOT TOO SHARP
SYMMETRICAL FILLER SPACES; SHOWS 3 CONDUCTORS HAVE BEEN SYMMETRICALLY CABLED
CONDUCTOR FITTED TO BULGE OF PAPER
LIGHT LAYERS INDICATE MANILLA LAYERS FOR "SLIPPAGE"
PAPER TIGHTLY WOUND; VERY FEW VOIDS

Translucent wafers make visible the results of careful cable fabrication

The section shown is from a 24-kv., three-conductor, H-type cable. This and the other pictures shown afford an interpretation that has only been made possible through co-operation of manufacturers who afforded access to their plants and permitted protracted stroboscopic studies to be made on their cable-making machines.

Commercial Data Sheets Developed as Sales Tool

Facts Regarding Local Customers Employed to Provide Organized Sales Ammunition for Utility Representatives

DURING the past year representatives of eight public utility companies in Pennsylvania, working together as the Commercial Sales Subcommittee of the Pennsylvania Electric Association, have developed a series of data sheets which are to assist in solving the problem of furnishing utility representatives with organized sales material for use in approaching prospective commercial customers.

A number of the sheets which have been produced up to this time are shown in adjacent columns. These sheets are specifically designed to be a part of a sales manual for commercial sales representatives. They are the first of a series that will feature outstanding sales applications for commercial electric service, including air conditioning, ventilation, refrigeration, cooking and various types of commercial lighting. In addition, the committee expects that these sheets may be useful as handouts by the salesmen and also as direct-mail pieces for a selected group of customers of utility companies.

The plans for producing the data sheets call for representatives of the Commercial Sales Subcommittee to prepare the story submitted by participating companies in form for publication as shown in the samples carried with this article. The front of the sheet is designed so that it will contain information which is of interest to the customer. On the back of the sheet, which is also shown, there is information for the sales representative.

In introducing these sheets the committee felt that there were certain distinct advantages which were worthy of special emphasis:

First—The committee felt that by printing these sheets for a number of

Electric Cooling Increases Cafe's Beer Sales

$3 PER BARREL MORE PROFIT
WITH ELECTRIC COOLING SYSTEM

With an electric cooling system, the Little Germania's gross income per half barrel has jumped from $5.00 to $8.50 — a gross profit increase of $1.50 per half barrel. On sales of 250 barrels per year, therefore, the cafe's annual gross profit increase would amount to $700.00, which pays for more than half the installation cost.

HANDLES "RUSH HOUR" BUSINESS

Like most neighborhood cafes, the Little Germania must be prepared to handle peak loads efficiently. This electric cooling system takes care of all the beer that can be served by two bartenders, working at top speed. It completely eliminates all sour, wild or flat beer. This better quality beer naturally results in increased business.

Electric Cooling Increases Cafe's Beer Sales

LOW OPERATION COST

The average operating cost for a month is $7.80. The increased profit which results soon pays for the cost of installation which in this case was $1,225.00.

TECHNICAL DATA

1 H.P. Heavy Duty Compressor.
1 Instant Cooler.
Capacity — 128 cus. per minute.
Temperature dropped from 85 to 40.

Modern Lighting Adds Lustre to Jewelry Displays

COMBINATION DIRECT-INDIRECT LIGHTING
DRAWS ATTENTION TO MERCHANDISE

Mr. Lester Smith expresses his satisfaction with the new, modern lighting of his store as follows: "May we take the opportunity to express our appreciation and our congratulations on a job well done. We accepted your plans for the particular lighting problem that confronted us. We followed this plan in detail and the results have proven to be most satisfactory.

"The lighting, a combination of direct and indirect, enhances the beauty of the store and concentrates attention on the displays where required. We are very well pleased with the results and offer our sincere thanks for your cooperation in working this out for us."

Modern Lighting Adds Lustre to Jewelry Displays

INSTALLATION PROVIDES GOOD ADVERTISING
AND SALES INFLUENCE

The quality of the fixtures and lighting are of the latest type and design — eliminating entirely the former poor distribution and glare, caused by cheap metal reflectors over the cases. The changes brought about spontaneous customer comment and reflected immediately in their buying attitude. Merchandise is now displayed in such an improved manner that both size and number of sales have increased. Installation proves to be valuable advertising and sales influence for store . . . . . in no way to be considered as just added overhead.

TECHNICAL DATA

New installation consisted of the following:
4 — 500 watt and 2 — 200 watt indirect units.
Intensity — 22 F. C.
4 — 200 watt reflectors recessed over cases with concentric louvres.
Intensity — 65 F. C.
All wall showcases lighted with 45 — 25 watt tubular lamps.
Intensity in windows 250 to 275 F. C.

Commercial Data Sheets developed by Pennsylvania electric companies—These are the first of a series to be used in sales manuals and as mailing pieces for groups of customers. Back and front of each data sheet are pictured here

"Electric Fry Kettles Indispensable," says Restaurant Owner

FASTER SERVICE FOR CUSTOMERS

Mr. Colapino, owner of Colapino's Restaurant, enthusiastically praises electric counter equipment as used for his type of business. Since his first purchase of an electric counter unit (a Fry Kettle) early in 1936, his business and use of electrical equipment have grown rapidly.

"Our electric fry kettles have been most profitable investments in our kitchens," he says. "Since we have installed these kettles we have used them for such a variety of foods that our cook now claims they are indispensable to our operation. We now give customers faster and more satisfactory service because with these kettles we can fry different foods in the same lot at the same time. We know our products are going to be uniformly well-cooked because of the accurately controlled temperature of the cooking fat. Cooking with these kettles requires less attention and makes work in the kitchen easier."

"Electric Fry Kettles Indispensable," says Restaurant Owner

COST OF CAPACITY USAGE IS LOW

The Colapino Restaurant finds that the operating cost per hour for capacity use on the electrical units is comparatively low. For instance, in one hour 75 orders for fillet steak can be prepared on the meat grill for the meager operating cost of 6.75 cents, which amounts to only a fraction of cent's worth of electricity per order. Complete comparisons follow:

UNITS		CAPACITY ORDERS PER HOUR
2 Fry Kettles	Cutlets	54
	Fish Fillet	134
	French Fried Potatoes	38
Operating cost per hour — 7.5 cents		
1 Meat Grill	Fillet Steak	75
	T-Bone Steak	38
	Chops	75
Operating cost per hour — 6.75 cents		
1 Sandwich Grill	Toasted Sandwiches	80
Operating cost per hour — 4.5 cents		
1 Waffle Baker	Waffles	13
Operating cost per hour — 3.0 cents		

TECHNICAL DATA

2 Counter fry kettles, each 2000 W.
1 Meat grill, 2200 W.
1 Sandwich toaster, 1500 W.
1 Section waffle baker, 1800 W.
1 Potato peeler and 1 dishwasher.

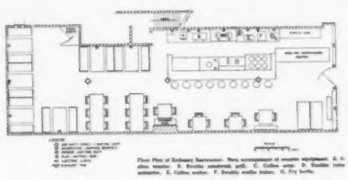
Electric Cooking Speeds Restaurant Service

CAN NOW SERVE 150 PERSONS DURING PEAK HOUR WITH ELECTRIC COOKING

"Speedy service and quality foods are demanded by the doctors, medical students, and business people who patronize our luncheonette," says Mr. Lyle Bain, of the Embassy Luncheonette. "To meet these requirements, we decided to use automatic electric cooking equipment.

"We use a toaster, grills and waffle-bakers on our lunch-bar, while our kitchen equipment includes an electric fry kettle. With these devices it is possible for us to serve 150 persons during our peak hour. We are satisfied that we have the most efficient and economical food service equipment now available for our needs."

Electric Cooking Speeds Restaurant Service



Floor Plan of Embassy Restaurant. Note arrangement of electric equipment: A, A, electric toaster; B, Double sandwich grill; C, Coffee urns; D, Double juice extractor; E, Coffee maker; F, Double waffle baker; G, Fry kettle.

EQUIPMENT ADDED AS BUSINESS INCREASES

As customer's business demanded better equipment, he wisely added units which in turn helped business more than ever. Addition of waffles to the menu, and a small glass coffee maker for off-peak business proved worthwhile. Finally, business increase was such that complete renovation was considered and almost immediately these changes were made. New lighting, better ventilation, additional coffee-making capacity, larger grill and an electric fry kettle were the results.

After three years of operation, increased business is again demanding larger floor space and kitchen facilities. Customer is now contemplating making these changes.

TECHNICAL DATA

Counter — Four-slice toaster, 2750 watts; double grill, 2000 watts; glass coffee maker, 1320 watts; double unit waffle baker, 1650 watts; counter type fry kettle, 2000 watts.

Lighting and Ventilation — three 300-watt direct lighting units; four 600-watt decorative wall brackets; two 200-watt window floods; seven 25-watt lamps back of fountain; 18-inch exhaust fan.

Connected Load — 6.50 KW.

Waffle Baker Proves Profitable to Drug Store

WAFFLES APPEAL TO APPETITES

Mr. Alpeo, manager of the May Drug Store, says of the above installation: "We recently found in our basement, carefully packed on a storage shelf, a perfectly good electric waffle iron. The thought struck us that waffles might appeal to the appetites of our patrons. Consequently, we added waffles to our regular menu and noticed that they were soon selling in preference to other items. This has pleased us very much because the profit on waffles is far greater than on other items and has, therefore, increased the earnings on our lunch business. In the electric waffle iron we had a treasure in the basement and didn't realize it."

Waffle Baker Proves Profitable to Drug Store

WAFFLES OFFER HANDSOME PROFITS

Selling price of one waffle	15c
Cost of one waffle:	
Waffle mix — 1.8c	
Waffle syrup — 1.5c	
Butter — 1.8c	
Electricity — .3c	
	4c
Profit on one waffle	11c

EQUIPMENT USED

Automatic double waffle baker for counter use — 1320 watts.

member companies it would be possible to obtain the material at a comparatively low cost. It was felt that since each company required only a small number for sales manual purposes, the cost to each company for producing its own material would be most impracticable.

Second—a more attractive sales manual is expected to result because the lower cost and the greater field will permit of a larger choice of material.

Third—In the committee's opinion, the interchange of a variety of information is of great assistance to salesmen.

Fourth—The plan employed by the Pennsylvania committee has the advantage of keeping the sales information localized in Pennsylvania and, further, of assuring that it is based upon reliable data gathered from utility sources.

It will be seen that the data sheets are arranged to appeal to the customer and it will be noted that the literature observes the first rule of all promotion pieces in that it talks about the customer's problems and talks about them in the customer's language. For example, the data sheet for fry kettles describes the opinion of a restaurant owner that fry kettles are indispensable. The sheet used for increasing the sales of cooling in a cafe calls attention at the outset to the fact that $3 per barrel more profit is secured with electric cooling systems. The data sheet used for a second restaurant points out that 150 persons may be served during a peak hour when electric cooking is used. Another sheet talks of a profit which accrues to a drug store by the use of a waffle baker. A jewelry store data sheet refers to the lustre which is added to jewelry displays by modern lighting.

These data sheets, prepared by utility men and used in utility companies, represent a current example of the modern merchandising methods now employed by the operating companies.

E. J. Ingram, Metropolitan Edison Company, is chairman of the committee and members include Philip M. Alden, Philadelphia Electric Company; A. J. Baumgarten, Pennsylvania Power & Light; J. R. English, Pennsylvania Electric Company; J. H. Grant, Pennsylvania Edison; Francis Kolb, Duquesne Light; H. E. LeVan, Philadelphia Electric; T. O. McQuiston, Duquesne; J. E. Mueller, West Penn, and F. C. Wise, Scranton Electric Company.

Editorials

Regulatory Commission Acknowledges Tax Problem

INCREASING rates to compensate, at least in part, for increasing taxes has long been one of the dreams that made up the utility managers' Heaven. Regardless of the fact that such a procedure is founded in equity to all parties concerned, it has nevertheless heretofore been only a dream and no more.

But now the equity of increasing rates to allow for increasing taxes has been recognized through the action of the New York State Public Utility Commission in ordering the Rochester Telephone Company to increase its rates ten cents per month per instrument because of rising taxes.

Lest this recognition of the severe tax problem saddled onto utilities be accepted too optimistically, it should be pointed out that in ten years the Rochester Telephone Company's state taxes have quadrupled and city, county and state taxes have almost doubled, and they now amount to $5.48 per year per instrument.

Yet the step is a salutary development, for it constitutes tangible recognition by a regulatory commission of the fact that utility rates cannot go down and utility taxes go up indefinitely.

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Perspective on Progress

PROGRESS in the technical arts is of the same essentially episodic character as in other phases of our civilization. A new idea, a radical departure from existing practice, comes along. It is regarded with little enthusiasm, with misgiving, perhaps, while a few braver souls experiment with it, try to make it work. Then, if it has merit, it is more widely adopted, until, imperceptibly, it becomes the accepted thing. And it serves in its turn, following that use of the thing it displaced, as the refuge of conservative minds when the even tenor of their ways is disturbed by another new development. An excellent illustration of this common, but sometimes difficult to discern, phenomenon appears in the previous issue of ELECTRICAL WORLD.

State Line station started operation with its first unit in 1929. At the time that its design decisions were made, two or three years earlier, steam conditions of 600 lb. pressure and around 700 degrees F. represented well-established modern practice, though lower pressures and temperatures were not then uncommon in comparatively new installations of major size. But also at that time there were one or two frankly experimental boilers and turbines operating on 1,200 lb. steam.

However, by the time the first unit went into operation at State Line the 1,200-lb. steam idea had made great progress. What was an experiment had now become advanced design. And the plans for additional capacity at State Line, reflecting good engineering thought, had to take this new development into account. And they did, magnificently. No trifling, partial recognition of the new thing, but a wholehearted, comprehensive embrace of it embodied in a single, large capacity unit. At the time that a 150,000-kw., 1,200-lb., single-shaft turbo-generator was ordered as No. 2 unit for State Line heads were shaken in distrust at such recklessness and the familiar, "Well, I don't know," was often heard.

Now, after the delay of depression times, No. 2 unit goes into operation at State Line. It is no longer the projection into futurity that it was in 1930. It is today's accepted practice.

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Hydro Power in Cost Focus

CAN THE impasse between the Washington Administration and the New England states over river power control be lifted in the interest of flood prevention? A partial answer may lie in the response of the Federal Power Commission and the Secretary of War to the New England governors' request for information as to the economic feasibility of power development at the various reservoir sites named in the Connecticut and Merrimac Valley interstate compacts. It is well known throughout the industry that the President's desire for federal control of potential water power in areas identified with his "Little TVA" scheme was a major influence in holding up ratification of these compacts by Congress. From all appearances New England has no stomach for a regional TVA undertaking, and the vigorous championship of state control of water power sites by the governors for many weeks, regardless of party affiliations, has resounded across the country with some resemblance to the Concord Bridge echoes of long ago.

Meanwhile public sentiment in the Northeast hopes for comprehensive flood prevention work on a non-political basis. There is reason to believe that a study of the economic values involved in various sites may show in many cases that local hydro power development is not warranted, and that flood control measures can be justified, *per se*. Whether flood control and power development should be combined in particular localities is a question for engineering

and not political determination. The U. S. Army Engineers' work in this direction deserves consideration and respect, and there are other authorities competent to contribute to a factual determination of state and federal policies and programs.

Northeastern utilities are doing an outstanding job in the co-ordinated operation of steam and hydro plants with the aid of extensive transmission facilities and very high-grade interconnection dispatching. It may confidently be asserted that the more the situation is studied by competent engineers the less pretext there can be for imposing a federal power control program upon this part of the United States. By putting the whole question into a cost focus, the New England governors have done a constructive act and laid a base for sound future policy in relation to the utilization of these potential resources and the protection of the people of their states from disastrous floods.

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Dielectric Research Makes Practical Contributions

RECONCILIATION of abstract research with the practical requirements of industry is not always easy. A case in point is the activities of the committee on electrical insulation functioning under a division of the National Research Council. If earlier researches and papers at sessions of this committee have appeared to be basic physical research rather remote from the practices under which power cables are developed, fabricated, inspected and tested, the most recent sessions of this committee revealed a program that apparently is moving more than ever toward a convergence of the academic and the practical. Of course, some of the papers still deal with abstractions. This is inevitable in a field that is so intricate in involving complex compounds of organic or semi-organic origin. Further, the processes of electrical breakdown and of insulation deterioration are still matters of some obscurity.

But the flavor of practicality was more than ever present. Techniques for determining degree of voids, for disclosing stability of oils under conditions of electrical discharge and for revealing imperfections in the process of taping were presented at the meeting. They bid fair to become working tools of the cable art. Added to a growing knowledge of the mechanics of insulation phenomena—without which electrical currents would be futile—these advances represent a wholesome addition to technology.

Commendation of Dr. Whitehead and his colleagues on the committee by the divisional chairman of the National Research Council was timely and well deserved because their work is increasingly contributing toward better insulation of electrical paths in machines, equipment and circuits.

Dispelling Some Clouds Around That West Penn Decision

ON DECEMBER 31, next, the West Penn Power Company will discontinue its direct selling of residential appliances and thus become the twenty-fourth utility company to transfer its direct merchandising sales onto the shoulders of dealers.

As news of the move travels around the industry, many questions are being asked by utility sales executives, as well as by utility management, as to the reasons which led the company to reach this decision. The questions have given way to rumors, and finally to statements which are not correct.

Perhaps the air may be cleared by citing a few facts which, beyond any doubt, had a direct bearing on the decision.

First of all, basically the industry's necessity is to build load as economically as possible, all factors being considered. West Penn believes that it can build residential load just as well under its new policy of dealer co-operation as it can through the direct sale of appliances.

Point Two—Nationally, merchandise sales expenses or net losses from merchandise sales expenses are perennial sources of controversy in rate proceedings in that some regulatory bodies refuse to allow them as a part of operating expenses in computing operating income applicable to the rate base. Legitimate and reasonable promotion and new-business expenses not involved in merchandising do not come within such prohibitions.

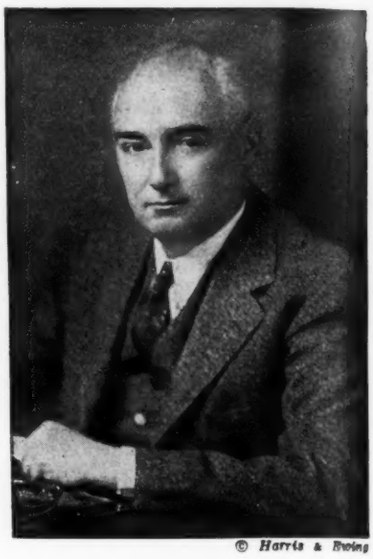
Point Three—Amendments to the Pennsylvania Public Service Company Law in 1933 resulted in increased taxes for straight selling operations as carried on under West Penn's present arrangement.

Couple to these salient points the fact that, in West Penn's case, building of residential load is of an especial importance because only 25 per cent of its revenues are derived from this source (see ELECTRICAL WORLD, October 23, 1937, page 65) and you have all the broad considerations which brought up the question in the first place.

To dispel a few of the current rumors, it may be said that West Penn is not going to stop load building. Quite the reverse. It will still aggressively sell industrial business and commercial business. As for residential business, it will probably spend just as much money as it has been spending, but will spend it all for promotional rather than partly for direct selling. Promotion will be aggressive and employ all media.

The new plan is so organized that employees, dealers and customers will derive added benefits. If these should not materialize, or if from the company's standpoint the plan does not develop as contemplated, then it will be modified. The company hopes to continue the new plan as long as the rate of growth of load is satisfactory.

Congress May Force President to Bend



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By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

PROBABLY the most important question in the United States today is whether President Roosevelt's dislike of the electric industry is going to cause him to bite off his nose to spite his face. Since the conferences last week with utility executives more than enough has leaked out to show that the President actually made no concessions whatever, but did obtain some very important concessions.

Lay critics who are interested merely in business recovery, though friendly to the electric industry, regard the conferences actually as beneficial, but *not* as indicating a peace between the White House and the electric industry. The chief benefit, as these critics see it, is that the stage is now set for lower electric rates by the privately owned utilities all over the country. Lower rates, these critics believe, will benefit the industry itself, intrinsically. But more important, they will weaken the arguments of the Norrises and the Rankins on Capitol Hill, and of the President's radical advisers.

This is tremendously important for the future. It is not likely that the present Congress, in its present temper, will give the President much encouragement on any plan for extending government ownership in the electric or any other field. But the present situation will pass. When the 1939 and 1940 Congresses meet the situation may be different. Whether it is better or worse, so far as business and employment are concerned, it *just might* be less favorable to the electric industry.

The point here is that if conditions are better Congress would no longer be worried about not frightening business, and hence might yield either to radical anti-utility pressure, or to the pork barrel demand for local spending. If conditions are worse, it might yield to pressure toward socialism.

In either event, the lower rates which are expected to result from these recent White House conferences would then stand the utilities in good stead.

The regrettable phase of the recent conferences, as these friendly critics see the picture, is that the President has shown not even the slightest indication that he has learned any lesson from what has happened—that he has the remotest idea that his policies as applied in government and, more important, as threatened to be applied, have anything to do with the present business recession.

President misadvised

The President, difficult as it may be for some to accept this, actually believes that the chief reason the utilities have not been spending a billion dollars a year for the last three years is that a small group of economic royalists, controlling the holding companies, have prevented the operating companies from making plant expansions, improvements, etc., with the only purpose to force the Administration to surrender on the utility holding company death sentence. He has been encouraged in this view by most of his radical advisers, including Chairman McNinch of the Power Commission. He has even been told it is true by Chairman Douglass of the Securities and Exchange Commission, who is not regarded as a radical.

The utility executives obtained no response to their contention to the President that the utilities needed new capital to make these billion dollar expenditures, and that they could not obtain it from investors frightened at what the Administration would do to their enterprises.

It may be too much to hope that the President will change his mind, for he very seldom does. But it is not too much to hope that the temper of Congress, plus the business situation so largely responsible for that temper, may *force* the President to bend before the gale, even if he should figure that it is only bending, and that he will be able to spring back to his original position when the wind stops blowing.

The attitude in Congress is that it believes fundamental conditions are sound, that if investors were encouraged to take a chance in order to make a profit there would be plenty of employment within a short time, and that the best way to encourage investors is to draw the teeth of some of the New Deal restrictions on business.

If the President continues to buck the tide he will risk two things: First, the danger that the present recession may become a real depression, the political effects of which would be difficult to calculate; second, the danger that the fight to hold his program of government regulation of business intact during this period of storm might so strengthen the opposition to him from conservative Democrats that they might be able to achieve their ambition.

Mr. Roosevelt knows perfectly well what this ambition is. It is to win con-

[*Continued on page 128*]

News OF THE WEEK

Public Opinion Seen as Forcing a Change in Attitude of New Deal

Roosevelt "depression" caught Washington by surprise, forcing maneuver to hold out co-operation hope to industry — TVA seen as becoming unpopular in area — Support grows for clipping of wings

By PAUL WOOTON
(Washington Correspondent for ELECTRICAL WORLD)

Majority sentiment in Congress has not swung from left to right because members have changed their views. It is because public opinion has changed. There are statesmen in Congress, but most members are politicians rather than statesmen. They are very clever in determining which way the wind is going to blow. Before a shift of sentiment is generally recognized the politician has taken his position on the popular side. Frequently the impression is created that he is the leader in the movement. As a matter of fact, he simply was more clever in the art of appraisement. He took the position in advance which he knew would become the prevailing one. These fundamentals must be understood to analyze what has happened in Washington that affects the utilities and to forecast what is likely to happen.

Loss of public confidence

The most important and far-reaching development reported is loss of public confidence in New Deal methods. A majority of the people had come to think that the policies of the administration insured against depression. All at once the realization began to dawn that despite the vast expenditures of taxpayers' money, devaluation of the dollar and other drastic measures, depression again is upon us. The Roosevelt depression came as a surprise and shock to every one, including the economists. New Deal experiments and excursions into business have become unpopular and the politicians, except the long-haired ones, have found it out.

The TVA has become unpopular even in the Tennessee Valley itself, say returning legislators. A part of this is due to the fact that much more is expected of a publicly operated service than a private one.

Outside the valley a bad impression has been built up by the refusal to allow an outside accounting, by the inability of members of the authority and key men on the staff to agree and by refusal to accept the pooling plan. Congress now is getting into the frame of mind to require sale of power at the switchboard of government dams.

Clip TVA wings

Support for clipping the wings of TVA also is coming from sections that fear a loss of industry. There has been just enough migration, and talk of migration, to excite fear in the minds of some members that there will be migration from their districts.

While the effort is continuing in certain Administration quarters to picture utilities as reservoirs of ill-gotten corporate wealth Congress recognizes that spending by the utilities depends upon their ability to float capital issues. Before that can be done the public must be convinced that the era of persecution is over. At present a majority probably would support legislation to that end. It is realized that such a move to be quickly effective will have to take dramatic form. For this reason some think Congress may require sale at the switchboard on a long-time basis, may cut the TVA or REA appropriations or do something else calculated to convince the public that nothing will be done to hurt an honestly run utility and that its stock well may be a good investment.

Legislators realize that the fact that 90 per cent of the field is still open to the private utilities does nothing to allay lack of confidence in utility investments. Just as the influence of yardstick rates is expected to spread over the entire country competition with its own citizens by government in ten per cent of the field undermines confidence in the whole utility business.

Power report a "dud"

A very unfavorable impression was created on Capitol Hill by the release of the report of the New York Power Authority which strengthened the impression that there is no real intention of co-operating with the utilities. There also is a feeling in Congress that the Federal Power Commission went off half-cocked in its statement concerning improper hypothecation of utility securities. The real facts concerning that situation may be made public on the floor with the idea of discouraging unfair attacks on utilities by public officials who do not like them. Incidentally, such officials are doing some quaking in their own shoe leather for fear Congress may take the bit in its teeth and offset all of the "progress" they have made.

Congress is expected to make public the suppressed report of the chief of Engineers on the seven TVA's and may sit on the whole regional planning idea, even on an advisory basis.

Compromise in Utility Peace Move Sought by Willkie in Memorandum

Proposes to abolish all protested "write-ups" and accept theory of "prudent investment"—Insists that U.S. end gifts to cities to compete with private utilities — Wants utility act clarified

Concessions to the New Deal power program and compromises designed to bring about co-operation between the government and private utilities were made in a memorandum to President Roosevelt by Wendell L. Willkie, president of Commonwealth & Southern Corporation. The basis for a solution to the problems created by the Administration's power policies was put forward by Mr. Willkie on November 23, when he conferred with the President at the White House.

Text of the memorandum submitted by Mr. Willkie to President Roosevelt:

Expresses personal views

In the interest of clarity I have prepared this brief memorandum with the hope that it will be helpful in working out a satisfactory relationship between the private utilities and the federal government. I have always thought that this could be done without injury to legitimate investment and well within the broad framework of your social objectives.

This memorandum represents my own personal views and proposals, acting on behalf of the Commonwealth & Southern Corporation. I do not speak for any one else. However, I am hopeful that if you find these suggestions agreeable other utilities may find in them a workable program.

In my judgment, the greatest immediate requirement of the utility industry is a large inflow of common capital indispensable for much-needed additional construction. Without arguing the causes of the present hesitancy of capital to invest in utility common stocks, I have certain suggestions which I believe will immediately stimulate such investment and make possible a large construction program with a considerable increase in employment.

One of the factors of great importance to the investor in the utility industry is a stable method of property valuation. You have recently recommended what I understand to be the "prudent investment" method. The utilities of the country have issued most of their securities and operated, for approximately forty years, under court rulings which have required that in fixing the value of utility properties the reproduction cost must be one of the elements considered. I shall not enter into a discussion of my views of the relative merits of these two methods. I think the chief objective is to find a method that will induce the investment of capital in the industry. I am fearful that the retroactive application of any new method would be disturbing to the capital market. On the other hand, the utilities, if informed in advance, can adjust themselves to a new method to be applied in the future.

Suggests formula

In order to reconcile conflicting ideas, therefore, while at the same time avoiding such disturbance, I have to suggest the following formula:

1. That the utilities immediately eliminate from their capital structures all write-ups heretofore claimed by the Federal Trade Commission.

2. That the utility valuation under the rule established by the courts apply either up to this date or to the date of the commencement of your first term as President and that after such date and for the future the prudent investment method be adopted.

But an understanding as to the method of valuation is, in my judgment, only one of the clarifications necessary in order to establish a relationship between the government and the utilities which will restore investment confidence in the industry. There are certain questions in the mind of the prospective utility investor with reference to such things as the action to be taken under Section 11 of the Public Utility Act of 1935; the procedure of selling power to be practiced by federal agencies such as the Tennessee Valley Authority, and the accounting practices to be followed by those agencies; the future policy of the federal government with regard to the making of gifts and loans to municipalities to build duplicate utility systems.

In order to answer these questions in the public mind, may I suggest the consideration of the following program:

1. Clarification of the Public Utility Act of 1935 as follows:

(a) Retention of all its regulatory provisions over financing and accounting practices, issuance of securities, relationship between operating companies and holding companies, etc.

(b) Modification of Section 11, the so-called "death sentence," so as to eliminate all intermediate holding companies within three years, but otherwise to confirm existing holding companies in their present ownership of property requiring that any future acquisition of property or securities shall be subject to the approval of the Securities and Exchange Commission or the Federal Power Commission.

Determine TVA policies

2. Determination of the following policies for the Tennessee Valley Authority and other similar federal projects:

(a) That the power therefrom shall be sold to presently operating utility systems, whether public or private, but at a price arrived at under the cost-accounting methods prescribed for private utilities by the Federal Power Commission, and that, in view of the loss to the consumer in the building of duplicate transmission lines, such duplication should be avoided by purchase if possible.

(b) That the rates at which power is distributed by these public or private agencies shall be fixed under the regulation of the Federal Power Commission.

(c) That if any municipality not presently operating a utility system desires to establish its own system and purchase power from the Tennessee Valley Authority or other federal agency such municipality shall be required to purchase at a price to be determined by a fair tribunal, the existing distribution system of the private utility in such city and a fair allocable amount of its generation and transmission system.

(d) That such purchase be made without any gift or grant from the federal government to avoid stimulating the disintegration of existing utility systems as caused by the present federal policy of making outright gifts to municipalities to duplicate existing distribution lines.

(e) That there should be a specific determination of the respective areas in which utilities and the federal government shall build rural lines or promote rural co-operatives.

(f) That disputed questions arising between utilities and federal agencies should, in so far as possible, be submitted under rules to the Federal Power Commission for settlement, in order to prevent the capricious determination of such questions by individuals and to eliminate the disagreements and public recriminations which led both to loss of confidence in federal regulatory processes and in the public utility business as an investment.

In the above suggestions I have subordinated my own views regarding the prudent investment method of evaluating utilities, which personally I have never considered the soundest basis of valuation for the consumer. Likewise, there are suggestions for corporate changes with reference to write-ups claimed by the Federal Trade Commission, the justice of many of which I seriously dispute. However, the utilities could constitute such a great force for the stimulation of recovery, and their satisfactory relationship with the federal government is so indispensable to their own well-being, that I make the above suggestions in the hope that they may constitute some basis for an amicable adjustment of the present differences.

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North Carolina Rural Lines to Serve 42,217 Customers

Director Dudley Bagley has informed the North Carolina Rural Electrification Authority that since it began operating in July, 1935, a total of 5,130 miles of power lines had been built in the state for 28,572 customers. Lines built, planned and under construction, he said, total 7,504 for 42,217 customers, at an estimated cost of $8,210,592. The report covers operations to November 1. Public utilities, the report showed, have built 4,352 miles of line, municipalities 460 miles and the Federal Rural Electrification administration 281 miles.

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Contracts for TVA Power; Plans Distribution System

Mayor Yancey Caldwell and the city legislative council of Paris, Tenn., have signed a twenty-year contract with the Tennessee Valley Authority for power to be supplied to a municipal distributing plant to be built with

funds derived from a bond issue of $300,000 and a Public Works Administration grant.

Actual construction of the municipal distribution system depends on a favorable outcome of litigation now pending in the Supreme Court of the District of Columbia, which would enjoin the PWA from making such grants to municipalities. TVA is not obligated to commence delivery of power to Paris before December 1, 1938. Russell, Hart & Reese of Nashville are making preliminary surveys of the city preparatory to the construction.

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Size of Shasta Dam Larger in New Plan

An increase in the size of the Shasta Dam, largest unit in the Central Valley project in California, that will make the structure the second largest concrete dam in the world is provided for in revised plans announced by the Bureau of Reclamation.

The revised design calls for a straight concrete gravity dam approximately 560 ft. high and 3,100 ft. long containing 5,700,000 cu.yd. of concrete. The reservoir capacity will be 4,500,000 acre-feet.

The initial power installation at the dam, located on the upper Sacramento River 13 miles north of Redding, will be 280,000 kw., with provision for future enlargement to 350,000 kw.

Shasta Dam will be supplemented by Friant Dam, another concrete structure, on the upper San Joaquin River east of Fresno.

New England Utilities Plan Budgets for Plant Construction Next Year

Comerford says New England Power Association and Boston Edison will spend between $30,000,000 and $35,000,000 — Carlisle tells Roosevelt Consolidated Edison will spend $100,000,000 in two years

Tentative construction budgets totaling between $30,000,000 and $35,000,000 for 1938 and 1939 are contemplated by New England Power Association and Boston Edison Company, according to Frank D. Comerford, chairman of New England Power and president of Boston Edison.

In a wire to Congressman John W. McCormack of Massachusetts, Mr. Comerford stated that the contemplated program of construction and expansion was "subject to the ability to finance soundly and on fair business conditions."

Responds to Congressman

The wire was in response to a query by Mr. McCormack as to the outlook for utility capital outlays next year. Mr. Comerford stated that "in connection with recent conferences in Washington we call your attention to the fact that Massachusetts companies have always been regulated under the prudent investment theory."

Officials of the two companies did not make public a breakdown of the proposed expenditures. For the two years they differ little from the average year's expenditure in the era of large expansion in the power industry. The schedule does include the $4,000,000 addition to the East Boston plant of the Edison company, already under construction.

From Milwaukee comes the announcement by J. P. Pulliam, president of the Wisconsin Public Service Company, that approval had been given to a $3,310,000 construction budget for 1938, more than double that of 1937. Mr. Pulliam said that the budget exemplified the pledge made by Wisconsin utilities to aid any business revival plan.

Included in the 1938 program is a new hydro-electric plant costing $1,675,000 on the Wisconsin River near Tomah, with a transmission line to Wausau.

Carlisle to build plant

Last week, as President Roosevelt was preparing for his Florida fishing trip, Floyd L. Carlisle informed the White House that Consolidated Edison would spend $100,000,000 during the next two years and that Niagara Hudson Power contemplated building a new 100,000-hp. steam plant in Oswego, N. Y., to cost $12,000,000. On December 15 a special election will be held in Oswego on a proposal to grant 25 years' extension on a lease by the city to the Niagara Hudson subsidiary on water rights to the Oswego River.

OPENS NEW PLANT—More than 80 utility specialists examined the lighting layout at the Warren Telechron Company at Ashland, Mass., recently at the first joint assembly of the Power Engineers Association and New England Lighting Engineers Club. President Henry E. Warren is seen in the center front row with H. B. Whitehead, factory superintendent, and W. S. Mowry, chairman of the Lighting Engineers, at his right, and Eben B. Haskell of Power Engineers at his left.

The city receives $50,000 a year for rental.

Mr. Carlisle told the President of his construction plans at the second of the conferences which the President is holding with leading utility executives. Wendell L. Willkie, president of the Commonwealth & Southern Corporation, whose companies are more affected by Mr. Roosevelt's power program, was the first utility executive to visit with the President.

Facing no immediate threat of competition from government hydro-electric projects, Mr. Carlisle was disposed to accept the President's assurances that there was nothing in the New Deal's present power policy to frighten utilities.

Other conferences planned

It is expected that when President Roosevelt returns next week from his fishing trip in Florida waters he will resume conferences with utility executives in an effort to bring about solution of power problems which are blocking utility construction and expansion.

Representative John E. Rankin, leader of the House power bloc, has demanded that the White House refuse to compromise with "purring" power magnates. "What they want to do is destroy the TVA yardstick and thereby wreck the Administration's power program," Mr. Rankin said.

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Sanctions New Rural Lines

Application of the Pennsylvania Power & Light Company for permission to extend thirteen rural lines to serve 64 customers, an extension which would also make electricity available to 67 other rural residents if they desire it, has been approved by the state Public Utility Commission. The company estimates the cost at $32,094. The total mileage is more than 27 miles and extends into eight counties.

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Plan New Power Plant

Construction of an electric plant of 7,500 kw. capacity in Moore County, Texas, by the Panhandle Power & Light Company will be started soon, according to C. R. Stahl, general manager. The plant will serve two 33,000-volt transmission lines which the company recently extended into this section.

Pressure Used to Force Purchase of Nebraska "Little TVA" Power

Declare threats were made that PWA would not advance funds for Loup power and irrigation project unless contracts were signed — Higher power costs seen — Project soundness questioned

Threats against Nebraska municipalities that they must purchase electrical energy from the Loup irrigation and power development, Nebraska's little TVA, or face the prospects that PWA would not make available funds for completion of the project have been disclosed following resignation of several Platte Valley officials.

Mayor Gould B. Flagg of Ord said charges of "pressure" in Ord's purchase of electrical energy from the North Loup Public Power and Irrigation district are "substantially correct." He said that Ord was given 30 days in which to make a decision on the contract for the purchase of power.

Cost seen higher

"We knew we would be paying more for electricity than it cost us to produce," Mayor Flagg said, "but we figured the extra expense as Ord's donation toward getting the irrigation project." The contract provides a rate of 1.67 cents a kilowatt-hour, but increased usage is expected to reduce the price to 1.20 cents in five years.

L. R. Williams, treasurer of the Burwell village board, confirmed the assertion that officials of the North Loup district project had used "pressure" to force the signing of a contract under the threat that PWA would not make available funds for the project. The manager of the Burwell municipal plant "insisted" that the city would generate its own electricity cheaper than the price quoted by the power district, Mr. Williams said. The same applies also to the Grand Island plant, it was said.

A. F. Buechler, resigned director of the Platte Valley district, said that the federal attitude was "the immediate and predominating" one among "several other good reasons" for his resignation.

The three Nebraska districts, Platte Valley, Loup River and Tri-County, plan to float a $100,000,000 bond issue to purchase private utility properties in the state. The Platte Valley district is considering purchasing the Western Public Service Company from Stone & Webster, Inc., through the sale of $7,565,000 of bonds. J. D. Ross, in charge of the Bonneville Dam project, set $6,681,000 as the value of the utility.

Officials resign

The resignation of officials of the power districts may lead to a thorough airing of the situation in Nebraska. Efforts have been successful in squashing a move to intervene in the scheduled hearings on December 8 before the Federal Power Commission to determine licensing or assuming jurisdiction over the Sutherland project by the commission.

Senator Edward R. Burke of Nebraska recently stated in the Senate, in discussing the reasoning of the Federal Power Commission in assuming jurisdiction over streams when power projects are proposed, that the principle applied in Nebraska was "that water flowing into the ocean makes the ocean more navigable." He said that the Platte River, "which is not and never has been navigable, has been declared to be a navigable stream and taken over in the same way, because, it is said, the Platte flows into the Missouri, that the Missouri is a navigable stream, and the waters of the Platte may increase the navigability of the Missouri."

Question project's soundness

Some of the municipalities feel that they may not be able to repurchase any power facilities bought by the $10,000,000 PWA-financed Platte Valley power project in the proposed $100,000,000 deal.

The soundness of the $50,000,000 PWA power investment in Nebraska is being seriously questioned, for it is held that power is now being generated by steam cheaper than it can be at the PWA hydro projects. Critics claim that the ice jams are likely to clog the works and lack of steady water

flow will add to the difficulties. Because of these, it is said, the districts are turning to the more dependable steam plants which they will acquire should the facilities of the power companies be purchased. This deal, it is claimed, will mainly pull PWA's chestnuts out of the fire.

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Duke Power Reduces Rural Electric Rate

South Carolina Public Service Commission announces it has secured a reduction in the rates for electricity supplied the Rural Electrification Authority of South Carolina by the Duke Power Company. Under terms of the order the REA has the right to continue purchasing electricity under the existing rates, rather than under the new schedules, if it so desires, the two schedules, new and old, being optional on the part of REA.

The new rate for REA is more flexible than the old one, because it includes a "demand" feature under which the REA pays $1.30 per kilowatt at peak load and 8 mills per kilowatt-hour for energy consumed. Under the present load factors this rate will amount to less than 1.4 cents per kilowatt-hour. Under the new rate, if the load factors and usage of energy is built up to the average of other residential service, the rate amounts to 1.2 cents per kilowatt-hour, or less. The present rate of 1.45 cents per kilowatt-hour will protect the REA in case the load factor grows less favorable in the future, L. W. Pollard, director of the commission's electric utilities division, stated.

The commission has also requested two other major power companies in the state, South Carolina Electric & Gas Company and South Carolina Power Company, to submit improved schedules.

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Carnegie-Illinois Completes New Power Station in Chicago

Carnegie-Illinois Steel Corporation will soon complete and put into operation a new power station, No. 5, at its South Works in Chicago, which will replace older equipment and provide for future expansion and, to a certain extent, will centralize power facilities.

Surplus blast furnace gas will be used as primary boiler fuel, with natural gas and oil and pulverized coal as secondary fuels. Building will house three boilers, each with a capacity of 300,000 lb. of steam per hour; one 25,000-kw. condensing turbo-generator, operating at 1,500 r.p.m., and three 75,000-cu.ft. per minute condensing turbo-blowers, operating at 3,000 r.p.m. against a maximum discharge pressure of 30 lb. per sq.in. gage. Space is also provided in the present building for one additional boiler and for a 50,000-kw. turbo-generator. Electrical control equipment will be housed in a separate two-story building.

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Electrical Gifts Campaign

An electrical gift campaign of the Georgia Power Company began November 29 and will continue through December 27, featuring twenty small appliances and offering $1,000 in cash prizes to those employees, not members of the regular sales staff, who sell largest amounts, in dollar volume, of small appliances.

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Chamber Censures Competition With Utilities

The threat of existing and further government competition in the public utilities field, which seriously prevents the privately owned properties from going forward with much-needed and delayed construction and re-equipment, was cited as one of five causes of the business slump by the recent report of the executive committee of the Chamber of Commerce of the State of New York.

Other causes listed were the undistributed profits and the capital gains taxes, federal legislation on labor, particularly the National Labor Relations Act, and the fear that the gold content of the dollar might suddenly be changed.

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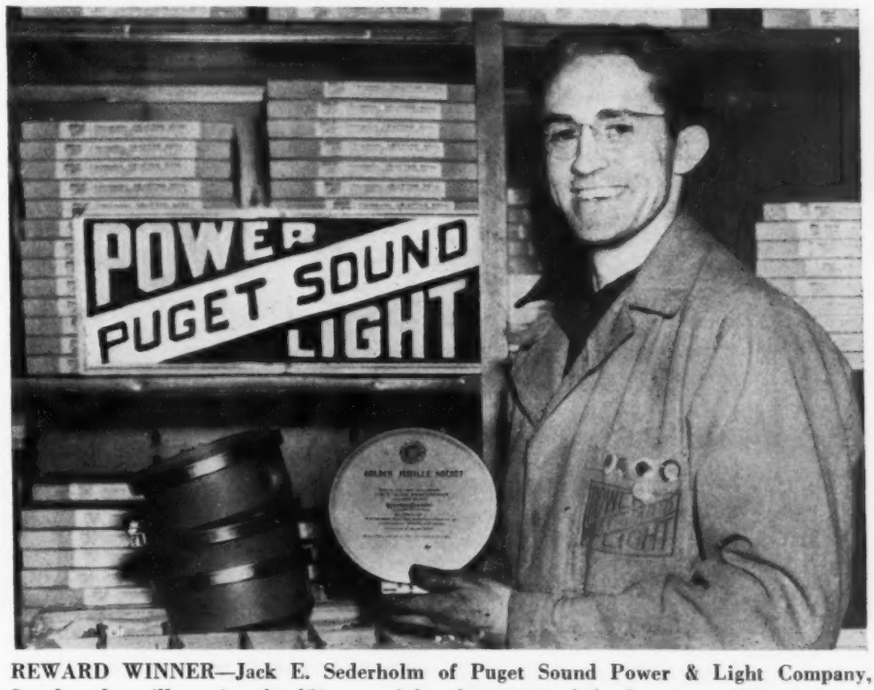
Westinghouse Socket, Long Lost, Is Found

For nearly a year Westinghouse Electric & Manufacturing Company has sought to find the two millionth CS meter socket which was packed on December 14, 1936, along with hundreds of others.

When it was discovered that the destination of this Golden Jubilee socket was unknown Westinghouse offered a reward of $50 for its return.

During the time many attempts were made to collect the reward by submitting counterfeit sockets, the company stated. As the search widened it was the sharp eyes of Jack E. Sederholm, located in the warehouse of the Puget Sound Power & Light Company in Seattle, Washington, that fell upon the lost socket. Happy over his discovery, Mr. Sederholm will get the $50 check.



REWARD WINNER—Jack E. Sederholm of Puget Sound Power & Light Company, Seattle, who will receive the $50 reward for the return of the lost two millionth socket of Westinghouse Electric & Manufacturing Company

Change in 7-TVA Bill Planned in New Move

Indications are that the much talked-of seven-TVA measure will be stripped of its innocuous provisions and leave it but a planning agency without power to construct hydro-electric dams.

This power measure has been hanging as an ax over the head of the utility industry since it was introduced at the last session of Congress. The prospects that Senator Norris, Representative Rankin and others in the power bloc would press for its enactment threw a scare into the utilities and investors with the results that utility expansion has been sharply curtailed.

While President Roosevelt placed regional planning as one of his four points on the program for the special session, House Speaker Bankhead has declared that "a good many seem to have the idea that the proposal would set up seven TVAs at once. That's not in contemplation, certainly not at this time."

Speaker Bankhead indicated that a new measure would be introduced eliminating altogether any possibility of additional power development and operation by regional federal agencies. Operations of Bonneville and Grand Coulee projects might come under the new measure.

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Rural Territories Defined

Indiana Public Service Commission has announced that it has defined territories to be served by privately owned utilities and the Rural Electric Membership Corporation in 28 counties. The REMC by law has a virtual monopoly to provide rural electrification in Indiana, but it has relinquished its right to private utilities in certain territories, many of which were close to cities, the commission said.

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High Point Contract Let

High Point (N. C.) City Council has voted to award the engineering contract for the proposed hydro-electric plant on the Yadkin River to Murray & Flood, engineers, of New York, at 5 per cent of the cost of construction.

Contract is made conditional upon approval by PWA and partially conditional upon favorable court decisions in cases now pending before the U. S. Supreme Court and the North Carolina Supreme Court. The 5 per cent proposal is based upon construction cost estimated at more than $4,000,000, and not on the cost of the project as a whole.

•

Jacksonville Plant Plans $2,500,000 Expenditure

Because of increased consumption by all classes of customers, residential, commercial and industrial, the Jacksonville (Fla.) electric plant has planned a program of extensions that will cost approximately $2,000,000 and an additional $500,000 will be spent to increase the transmission lines facilities.

Contracts have already been awarded for a 42,857-kva., 3,600-r.p.m. turbo-generator and exciter, 400-kw. dual-driven exciter with regulator and accessories, 46,000-sq.ft. surface condenser with geared turbines and accessories, 11,500 condenser tubes, 1,500-hp. boiler and accessories, superheater, soot blowers, combustion control, furnace, air preheater, ducts and flues, steel work, etc. Bids will soon be asked on switchboard changes and additions and steam specialties.

LANDSLIDE—Linemen perched high on steel towers removing power lines endangered by the moving mountain in the Elysian Park area in California

Grand River Project to Cost $20,000,000

Oklahoma's Grand river hydro-electric project will not exceed the estimated cost of $20,000,000, according to W. R. Holway, chief engineer. Holway and his associate, H. C. Neuffer, will receive as their fee 5 per cent of the $12,000,000 it is believed the dam proper will cost.

R. V. L. Wright of Avalon, Cal., has been selected as manager of the project at a probable salary of $15,000 a year. The selection was made after it was indicated to the Grand River Dam Authority that Mr. Wright was the definite choice of Secretary of the Interior Harold L. Ickes, who as PWA chief had to approve all the GRDA principal appointments.

Mr. Wright has built and managed public power projects, was electrical engineer for the sanitary district of Chicago and has done special work at PWA headquarters in Washington in connection with power projects.

•

Michigan Chain Store Tax Affects Utilities

Recent decision of the Michigan Supreme Court definitely brings the branch offices of utilities in the state—offices where appliances and lamps are sold—under an act passed by the legislature in 1933 imposing a tax on chain stores.

Comment on the act and on the decision of the Supreme Court was obtained from Harry A. Snow, comptroller of Detroit Edison Company, who said:

"The wording of the act was such that it seemed to apply to the sixty-odd commercial offices operated by Detroit Edison Company for the convenience of its customers. In each of these offices it has been our practice to display and sell electric appliances with greater effort on display than on sales. We have always sought to throw the appliance sales business toward the local merchants and our appliance business is regulated to accomplish this end.

"The tax rises with the number of stores in the chain to a maximum of $250 per store on all over 25. Some of our branch offices are in small villages with almost no sales. Our first move was to stop the sale of appliances in a few of these marginal of-

fices. Doing so, we lost almost no sales and we saved taxes at the maximum rate. At the same time we took the matter up with the state administrative officers and now it has finally been adjudicated by the Supreme Court. Our contention was that the appliance business was incidental to the electric business, that the making quickly available of incandescent lamps and appliance repair parts was essential to and a part of our regular electricity service, that we were not truly a chain under the intent of the act. The case was won in the lower courts, but was lost on appeal in the Supreme Court.

"Accordingly we shall have to pay a considerable chain store tax. We are now considering the advisability of further eliminating the sale of appliances, incandescent lamps and appliance repair parts in the smaller offices of the company. It is unfortunate that it is in the smaller towns that this is necessary, because in these towns there are few effective selling agents in the electrical field."

•

Refrigerator Sales Advance in October

Domestic sales of household refrigerators in October totaled 63,111 units, valued at $5,699,602, compared with 40,386 units, valued at $3,314,733, in October, 1936. For the ten months ended October domestic sales amounted to 2,017,991 units, valued at $172,232,279, compared with 1,709,038 units, valued at $138,180,317, in the similar period of 1936.

World sales in October totaled 72,490 units, valued at $6,422,839, compared with 53,191 units, valued at $4,209,133, in October, 1936. World sales for the ten months ended October totaled 2,189,102 units, valued at $185,094,410, compared with 1,863,474 units, valued at $149,504,138 for the corresponding period of 1936.

•

Line Voltage Increased

Ohio-Midland Light & Power Company has announced the completion of a $25,000 project to increase the capacity of the Ashville and Canal Winchester substations. The line voltage from the Pickway power plant to Ashville and Canal Winchester has been raised from 27,000 volts to 40,000 volts.

McGraw Co-operation Award Goes to Brand

In recognition of his contribution to the advancement of co-operation in the electrical industry, Edward A. Brand, commercial engineer with the Buffalo, Niagara & Eastern Power Corporation, has been awarded the James H. McGraw Award Medal for Co-operation for 1937. The award

was made at a dinner in Buffalo last Tuesday sponsored by the Electrical League of the Niagara Frontier.

As chairman of the N.E.L.A. wiring committee and later the industry committee on interior wiring design, Mr. Brand has promoted harmony of purpose among the several branches of the industry and established a progressive specification standard for encouraging more adequate electrical installations.

The citation, in part, stated: "He has successfully brought to conclusion the adoption of standards for interior wiring design, that for the first time provide a clear concept of what constitutes adequacy, on a basis that may be progressively advanced as public acceptance warrants. Also, these standards have prepared a foundation of common agreement and closer team work upon which the electrical industry's Adequate Wiring Promotion Program has been organized."

The committee of judges making the award consisted of J. L. Busey, president General Electric Supply Company; J. L. Flagg, president Watson-Flagg Engineering Company, Inc.; Charles E. Swartzbaugh, president Swartzbaugh Manufacturing Company; George E. Whitwell, vice-president Philadelphia Electric Company, and Earl Whitehorne, representing the committee of awards.

Every effort on the part of industry should be directed toward co-operation with government in the movement to halt the present business recession, Floyd L. Carlisle, chairman of Consolidated Edison and the Niagara Hudson Power Corporation, declared at the dinner.

Mr. Carlisle rejected state socialism, which would have the government own and operate all basic industries and minutely regulate them, as well as extreme *laissez faire*, holding that a middle ground was the best economic path.

Asserting that the railroads and the public utilities are being looked at realistically by the federal government, Mr. Carlisle said that "I am very hopeful that an improvement in their credit and capacity to buy durable goods and to relieve unemployment is in the process of being greatly aided, if not wholly solved."

•

Predict Calmer Days for Public Utilities

Calmer days for the public utility industry, with a growing realization on the part of the companies that the customer is the "boss," were predicted by Philip B. Niles, advertising director of American Water Works & Electric Company, Inc., at the recent annual convention of the New Jersey Utilities Association.

Mr. Niles declared that "today, in the feeling that we must consult with and be governed by our customers' wishes, lies a brilliant future for the utility business." He stated that by speaking the customers' language and through courteous and sincere service better public relations could be gained.

Because the utilities were more concerned with building power plants and getting service to a great number of people, the companies failed to appear concerned with public opinion, Mr. Niles stated.

•

Reports Big Appliance Sales

Washington Water Power Company and associated dealers sold 8,214 units of household electrical equipment in September, Lewis A. Lewis, assistant general manager in charge of sales, has announced. Among the larger items were 1,500 I.E.S. lamps, 382 refrigerators, 217 electric ranges, 198 water heaters, 1,280 radios and 690 washing machines.

Pacific Gas Workers Vote on Utility Union

In the first election among employees of an electric utility in California under the Wagner Act employees of the Pacific Gas & Electric Company decided this week which of three labor organizations they wanted to represent them for collective bargaining purposes.

Outside field employees, workers in generating plants, substations, steam and gas plants, meter readers, salesmen, collectors and estimators voted for either the CIO United Electrical and Radio Workers of America or the incorporated Independent California Gas and Electric Employees Union, the AFL International Brotherhood of Electrical Workers having asked that its name be withdrawn from the ballot.

Employees of the P. G. & E. transit system in Sacramento chose from among these two organizations and the AFL group, Amalgamated Association of Street Electric Railways and Motor Coach Employees of America, Local No. 256. Many of the transit employees have joined the independent union or the CIO group.

•

Conducts Lighting Contest

Houston Lighting & Power Company is conducting a contest in which it will give total prizes of $500 for a letter of not more than fifty words, completing: "Adequate light is indispensable in my home because ———." First prize will amount to $200.

•

Consumers Power Contract

Consumers Power Company has awarded a construction contract to Owens, Ames & Kimball, Inc., Grand Rapids, Mich., for the new John C. Weadock generating station at the mouth of the Saginaw River, near Bay City, Mich., for which plans have been under way for several months. Erection is scheduled to begin at once.

•

Sales School to Convene

The twelfth annual sales and distribution school of the Iowa Public Utilities Association is to be held in Des Moines January 24-25 at Hotel Fort Des Moines, with Charles M. Clark, district superintendent, and J. D. Schilling, commercial manager for the Des Moines Electric Light Company, in charge. More than 400 public utility employees and executives are expected to attend.

•

Florida Power Sales Campaign

During a thirteen-week program sponsored by Florida Power & Light Company and co-operating independent dealers 13,636 electrical appliances were sold, including 5,554 refrigerators, 1,437 ranges, 611 water heaters, 20 dishwashers, 257 roasters, 3,857 fans, 950 washers, 149 ironers, 699 vacuum cleaners, 33 air cooling and 69 home-ventilating units.

•

SEC Rules on Utility Posts

An amendment to rules under the Public Utility Holding Act extends from January 1, 1938, to January 1, 1939, the period in which independent officers or directors of financial institutions may continue to act as officers or directors of registered holding companies or subsidiaries, according to an announcement by the Securities and Exchange Commission.

•

Set E.E.I. Convention Date

The 1938 convention of the Edison Electric Institute has been scheduled for June 7, 8 and 9 at Atlantic City, N. J.

Meetings

American Society of Mechanical Engineers—Annual meeting, New York, N. Y., December 6-10. C. E. Davies, national secretary, 33 West 39th Street, New York, N. Y.

American Engineering Council—Annual meeting, Mayflower Hotel, Washington, D. C., January 13-15. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 24-28. H. H. Henline, national secretary, 33 West 39th Street, New York, N. Y.

Canadian Electric Association—Annual winter conference, Windsor Hotel, Montreal, Que., January 31-February 1.

National Electrical Manufacturers Association—Midwinter meeting, Waldorf-Astoria Hotel, New York, N. Y., February 7-12. W. J. Donald, managing director, 155 East 44th Street, New York.

Wiring Bureau Heads Approve New Program

Subject only to a few minor revisions, copy and layouts for the complete program comprising two plan books and 38 promotional items were officially accepted by the executive committee of the National Adequate Wiring Bureau at a recent meeting held at N.E.M.A. headquarters in New York.

As a result of this meeting, the plan committee was authorized to proceed with the necessary production work with the idea of making all material available for distribution early next year.

Herbert Metz, chairman of the plan committee, was appointed chairman of a publicity committee to be composed of L. W. Davis, managing director of the National Electrical Contractors Association; C. E. Greenwood, commercial director of E.E.I., and O. C. Small of the N.E.M.A. staff. Mr. Small was also named secretary of the National Adequate Wiring Bureau.

•

Harry Hampton Hunt Dies

Harry H. Hunt, vice-president and former chairman of the Stone & Webster Service Corporation, Boston, died, from a heart attack, November 30 while on his way home from his office.

•

Objects to Valuation System

Valuation of utilities according to reproduction cost, both for rate making and security issues, was described as a "dangerous fiction" by Thomas C. Buchanan, member of the Pennsylvania Public Utility Commission, in an address before the 42d annual convention of the Pennsylvania Water Works Association in Atlantic City. He declared it is time to consider changing the procedure.

•

Joint Petition to Be Heard

Federal Power Commission has ordered a hearing to be held on December 15 upon the joint applications filed by Mississippi River Power Company, Missouri Transmission Company and Iowa Transmission Line Company for approval of the transfer of the facilities of the Missouri Transmission Company and the Iowa Transmission Line Company to the Mississippi River Power Company.

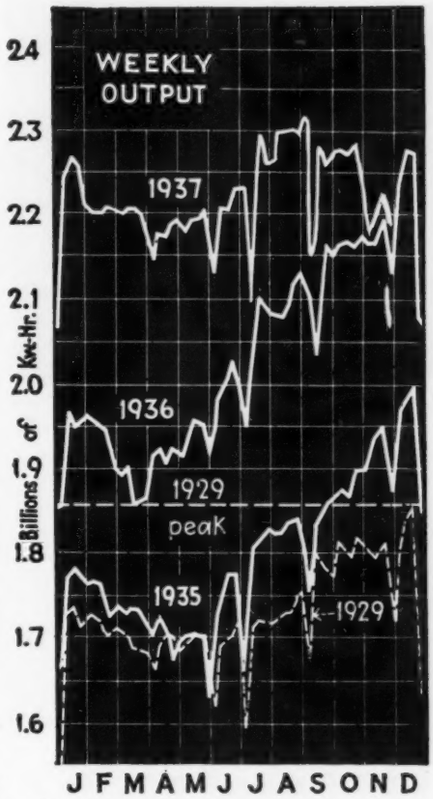
Holiday Cuts Energy Output

Production in Thanksgiving week drops 159,000,000 kw.-hr. to lowest amount this year

After an upward turn in the preceding week the output of energy by the electric light and power industry fell off sharply during the week ended November 27 to the lowest value for any like period of the present year. It amounted to 2,065,378,000 kw.-hr., down 6.0 per cent from the corresponding figure a year ago, according to the Edison Electric Institute.

The comparison is somewhat misleading, however, since the 1936 week did not include Thanksgiving Day. Adjusted for this difference, the deficiency becomes 3.2 per cent. The new figure is slightly under the 2,069,266,000 kw.-hr. reported for the week of January 2 and materially under that for any other week this year, including those affected by holidays.

The two regions of the far West alone retained a substantial lead over a year ago. The sharpest declines were registered in New England and the East North Central States.



Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Nov. 27...2,065	Nov. 21..2,196	Nov. 23..1,953
Nov. 20...2,224	Nov. 14..2,170	Nov. 16..1,939
Nov. 13...2,177	Nov. 7..2,169	Nov. 9..1,914
Nov. 6...2,202	Oct. 31..2,176	Nov. 2..1,897
Oct. 30...2,255	Oct. 24..2,167	Oct. 26..1,896
Oct. 23...2,282	Oct. 17..2,170	Oct. 19..1,863

Per Cent Change from Previous Year

Region	Week Ending Nov. 27	Nov. 20	Nov. 13
New England	—12.0*	— 6.4	— 6.9
Middle Atlantic	+ 0.2*	+ 2.3	+ 1.7
Central Industrial	— 5.8*	— 0.3	— 1.9
West Central	— 0.9*	+ 1.8	+ 0.8
Southern States	— 3.0*	+ 0.0	+ 0.9
Rocky Mountain	+10.6*	+16.4	+17.9
Pacific	+ 5.3*	+ 6.7	+ 6.6
United States	— 3.2*	+ 2.5	+ 0.3

*Adjusted for holiday conditions.

Los Angeles Bureau Issues $10,200,000 Revenue Bonds

The department of Water and Power, Los Angeles, has awarded to a banking group headed by Lehman Brothers $10,200,000 of its electric plant revenue bonds, consistsing of $9,000,000 as 3¾ and 3¼ per cent bonds and $1,200,000 as 2 and 3 per cent bonds, designated respectively as the second and third issues of 1937. The bonds were offered to the investing public last Thursday.

Proceeds from the sale of the $9,000,000 bonds will be used primarily for the initial work in providing for additional capacity, either through the construction of a steam generating station or the building of a third transmission circuit from Boulder Canyon power plant, and various other additions, betterments and improvements. Proceeds for the sale of the $1,200,000 of bonds will be used primarily for construction work on the distribution system.

•

Utility Gets Allotment

REA has allotted $323,000 to the Arkansas Power & Light Company to build distribution lines in four scattered areas in Arkansas which are contiguous to the company's system and in which public or co-operative projects were deemed unfeasible. The company will build 503.2 miles of line to serve 1,652 customers. The allotment is the result of extended negotiations between the company officials and REA.

•

Urges Utility Appraisal Cut

A $20,000,000 reduction in appraisal of property of the Indianapolis Power & Light Company for rate-making purposes was recently recommended by the public counsellor of the Indiana Public Service Commission, who fixed the estimate at $50,500,000.

•

Power Output Shows Gain During October

Production of electricity for public use in the United States totaled 118,778,000,000 kw.-hr. in the year ended October 31, according to the Federal Power Commission.

Total production in October was 10,148,000,000 kw.-hr., as against 9,981,000,000 kw.-hr. in September. This is an increase of 1.7 per cent over the previous month and, on a comparable basis, is an increase of 4.4 per cent over October, 1936. Production of water power in October was 32 per cent of the total.

The total stock of coal on hand at electric utility plants on November 1, was 10,630,084 tons, of which 9,241,342 tons was bituminous. This was an increase of 3.3 per cent over October last year and an increase of 40.1 per cent over November 1, 1936.

Electric utility plants consumed 4,098,788 net tons of coal in October.

•

Ontario Primary Load Up

The total primary load of all systems showed an 11.3 per cent increase in October over October, 1936, according to figures released recently by the Ontario Hydro-Electric Power Commission.

•

Chemical Show in New York

The sixteenth Exposition of Chemical Industries will be held at the Grand Central Palace, New York, on December 6-11. Many electrical manufacturers will have their products on exhibition at the exposition.

•

Utilities Seek to Merge

Merger of the Lehighton Electric Light & Power Company and the Pennsylvania Power & Light Company has been proposed in an application filed with the Pennsylvania Public Utility Commission. The Lehighton company is a subsidiary of Pennsylvania Power and the merger would simplify intercorporate relations and effect economies.

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Submerged Mats Used as Bonneville Ground

By **MAJOR THERON D. WEAVER**
Corps of Engineers, Bonneville, Ore.

Main grounds for the hydro plant at Bonneville, Wash., include two huge submerged mats of unique construction buried 800 ft. apart and 300 ft. downstream from the power house. These mats, formed by driving 20-ft. ground rods at elevation —6 below sea level on 10-ft. centers and connecting them with No. 4/0 cables, are joined to a ¼ × 4-in. copper bus through the downstream tunnel of the plant. Main cables from bus to mat are two 500,000-circ.mil copper in parallel.

One mat is located in the north side of the ship approach channel. It consists of 36 20-ft. Copperweld ground rods driven in gravel and boulder and it has a finished total resistance of 4.2 ohms. The resistance of individual rods varies from a maximum of 290 ohms to a minimum of 8.8 ohms. A total of 640 ft. of rod was driven in making this mat out of a possible 720 ft. Considerable difficulty was experienced in driving the rods due to the rocky soil.

The second mat, installed in the north side of the tailrace and consisting of 30 20-ft. rods in sandy soil, has a final resistance of 1.34 ohms. Resistance of individual rods varies from 39 ohms to 2 ohms. Total mat resistance dropped from 1.9 to 1.34 ohms when the tailrace was flooded. Both mats are kept as close to shore as possible and under hand-placed riprap so that future dredging will not disturb them.

The 36 rods in the ship channel mat were driven and connected in 120 man-hours at an estimated rate of one 20-ft. rod in 25 minutes. Driving of the rods was speeded by the use of a compressed air hammer mounted on the end of each rod and held in position by four men with guys, as shown in the accompanying illustration.

Compressed air hammer atop 20-ft. ground rods speeds installation of ground mats at Bonneville

Bonneville ground mats installed in tailrace and ship channel consist of 20-ft. ground rods interconnected with cable and covered with hand-placed riprap.

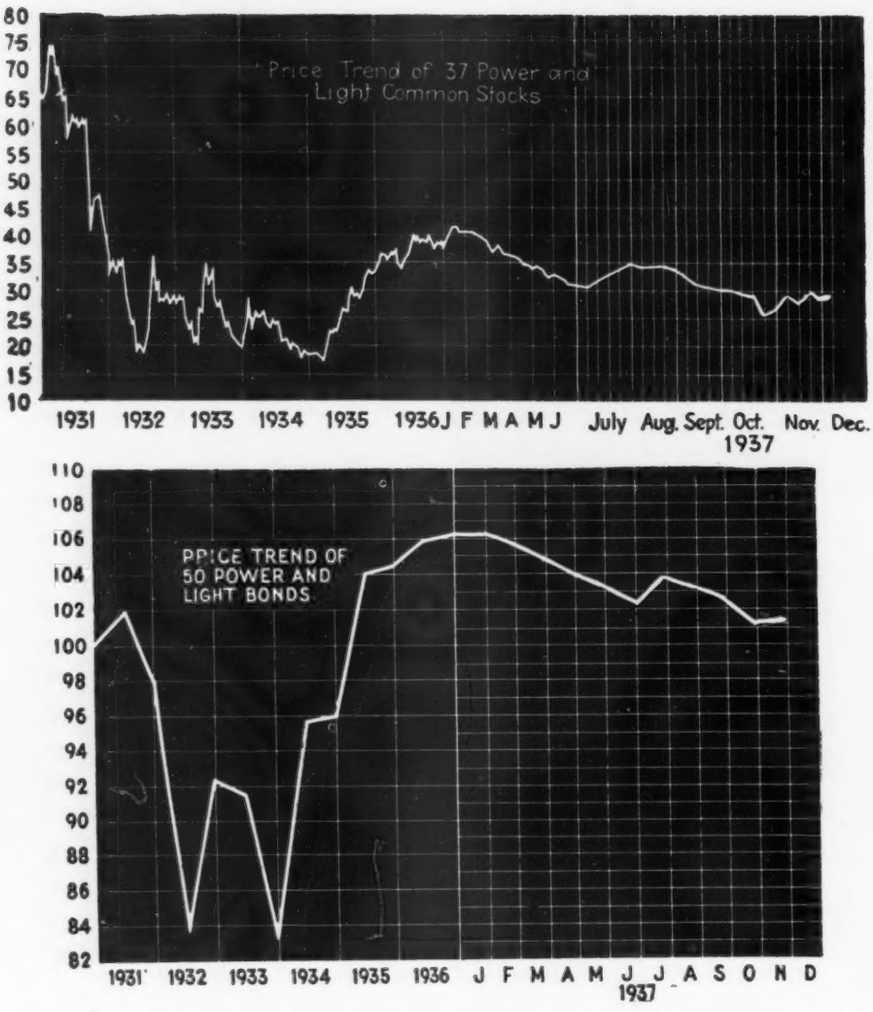
•

Chill Rotor Shaft to Separate from Spider

The problem of removing a 30-ft. hollow steel shaft 32¾ in. in diameter from a cast-iron spider 5 ft. long, total weight 307 tons, faced engineers of the Ontario Hydro-Electric Power Commission when the shaft of No. 10 generator at Queenston Hydro plant developed a serious crack recently. The job was accomplished by the novel method of shrinking the hollow shaft with a refrigerant consisting of alcohol and carbo-ice (solid CO_2). An 8-in. diameter hole throughout the entire length of the shaft furnished a convenient means for circulating the alcohol-carbo-ice refrigerant. Preliminary plans were in detail as follows:

1. Gradual heating of the rotor until the laminated iron reached 80 deg. C.

Utility Stocks and Bonds Hold Level



Utility stocks held their ground last week, although they did not reflect the rise in the general market, influenced, according to some observers, by the President's housing message. "Electrical World" index, 28.1; previous week, 28.0. Utility bonds, too, were comparatively firm during the month, index shifting from 100.9 to 100.8; year ago, 106.3; 1937 high, 106.0

Standard Gas Plan for SEC Registry

According to the latest plan for reorganization of the Standard Gas & Electric Company, presented last week for approval to the United States District Court at Wilmington, Del., the company plans to register as a holding company with the Securities and Exchange Commission under the terms of the Public Utility Act of 1935 upon consummation of the plan of reorganization.

Bernard W. Lynch, president, announced that the company would seek permission for solicit acceptances of the plan from holders of securities of the company, who, for the first time, would be asked to consider a plan in the reorganization proceedings.

Accompanying the plan is a letter from C. Roy Smith, director, public utilities division, SEC, to Mr. Lynch. The letter points out that while the staff of this division has seen this latest plan, this action should not be construed to indicate that the plan, or any part of it, meets with SEC approval. Mr. Smith remarked, however, that when the company registers with the SEC, "we shall be happy to consider any plan that may be filed with us."

•

Court Upholds Stock Sale

The Appellate Division, New York Supreme Court, has approved unanimously a lower court's refusal to enjoin auction of 712,411 shares of Jersey Central Power & Light Company common stock, collateral supporting National Public Service Corporation debentures.

Injunction proceedings were instituted in behalf of the Associated Gas & Electric System, which wished to see the stock distributed pro rata among debenture holders.

•

L.I. Lighting Reduces Preferred Dividends

Directors of the Long Island Lighting Company at a recent meeting voted to cut dividends on the company's 7 per cent and 6 per cent preferred stocks in half. Queens Borough Gas & Electric Company, a subsidiary of Long Island Lighting, also reduced by one-half the dividend on the company's 6 per cent cumulative preferred stock.

In announcing the dividend cuts to stockholders Edward F. Barrett, president of both Long Island and Queensborough Gas, indicated that despite an increase in gross earnings Long Island Lighting would not earn the full preferred stock dividend requirements this year. He cited the New York state tax of 2 per cent on gross revenue as amounting to $240,000 annually; higher labor costs more than $200,000 a year; mounting costs of materials and supplies, and retirement of annuities and pensions costing in excess of $180,000 for 1937.

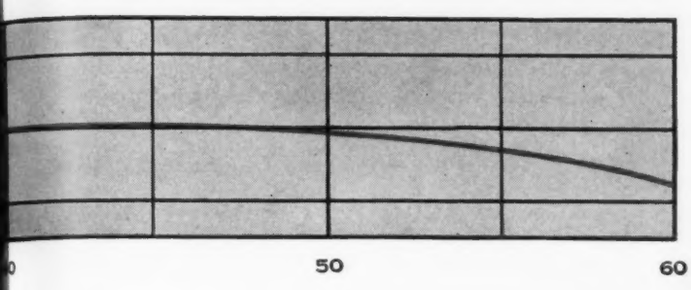
He estimated that the new money requirements of the system for 1938 would be approximately $1,500,000, in addition to approximately $400,000 necessary to complete the new turbine installation already in the process of construction.

Earnings Reports (Utilities)

	Net Income 1937	1936
*Assoc. G. & E. and subs	$34,430,146	$36,245,866
†Commonwealth Edison	12,280,997	7,980,634
*Common. & South. and subs.	15,935,468	12,204,141
‡Standard Gas & Elec.	2,162,767	1,917,294
*Nat. Pwr. & Lt. and subs.	8,863,931	6,950,115
*Amer. Pwr. & Lt. and subs.	11,274,470	10,444,961
‡Pacific G. & E. and Subs.	25,722,371	23,721,713
*Consumers Power	10,177,456	8,583,264
*Ohio Edison	4,806,157	4,028,537
*Alabama Power	3,945,740	3,530,278
*Georgia Power	5,037,932	4,900,921
*Montana Pwr. and subs.	3,736,071	2,968,807

*Twelve months ended October 31.
†Ten months ended October 31.
‡Twelve months ended September 30.

for LARGE and SMALL Single-phase Loads



IT'S THE G-E TYPE I-30

THESE curves tell the story of a development that will bring long-lasting benefits to electric-service companies.

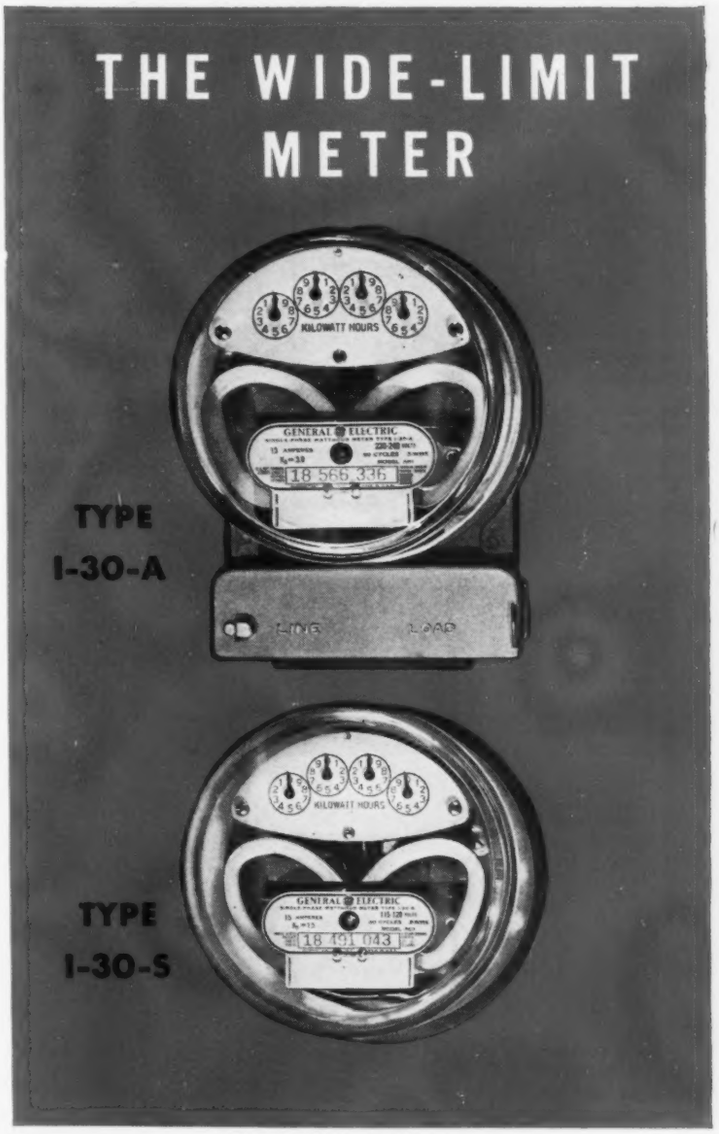
They show the performance of the G-E Type I-30 single-phase 3-wire watthour meter rated 15 amperes, 240 volts, 60 cycles. From the curve above, you can see that regardless of the size of load—large or small—this meter has an almost straight-line characteristic between the amazingly far-apart limits of 0.5 and 60 amperes.

This ability of a single meter to handle such wide variations in load simplifies your whole meter problem. It reduces inventory investment, keeps down maintenance expense, and protects revenue.

But that is not all. See, from the other curves, how little the I-30 meter is affected by changes in power-factor, temperature, voltage, or frequency. It comes close to being the ideal meter.

The time has come when you can profit by this development—and without making any change in your present set-up. In no way has it departed from any established standardization program. You can get the Type I-30-A meter for bottom connection with either connection box or protector case or the Type I-30-S meter for socket mounting.

There are other advantages in the use of the wide-limit meter which will gladly be explained by a G-E meter specialist, whom you can reach through the nearest G-E sales office. Or address General Electric Company, Dept. 6—201, Schenectady, New York.



GENERAL ELECTRIC

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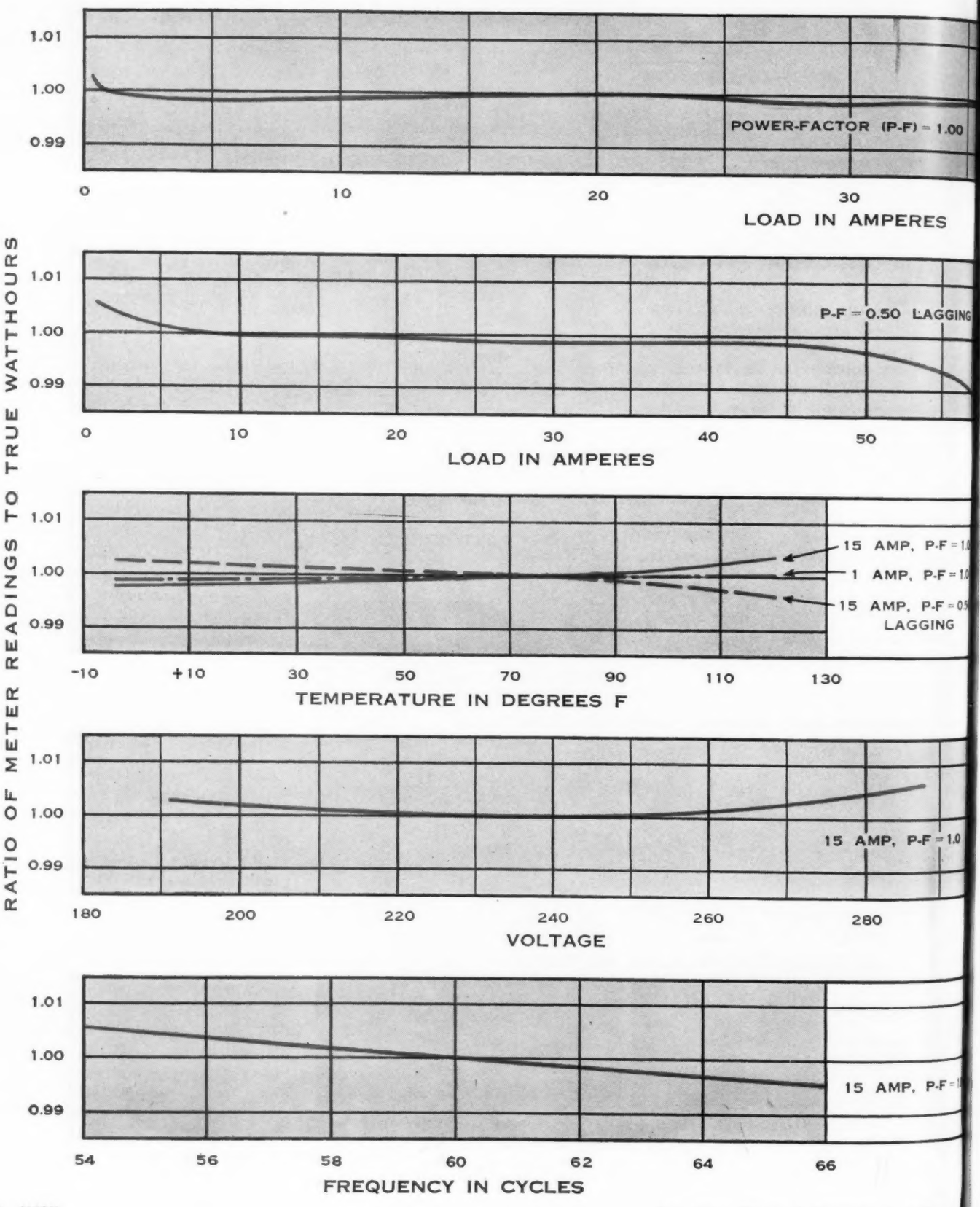
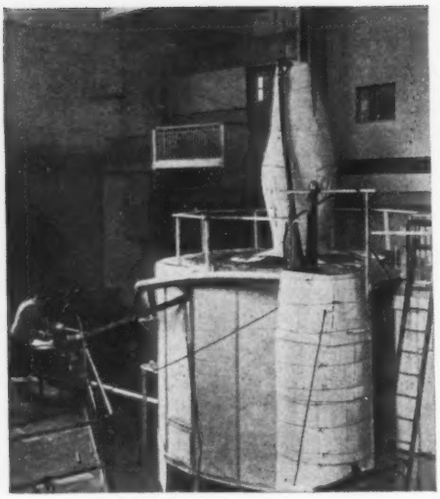
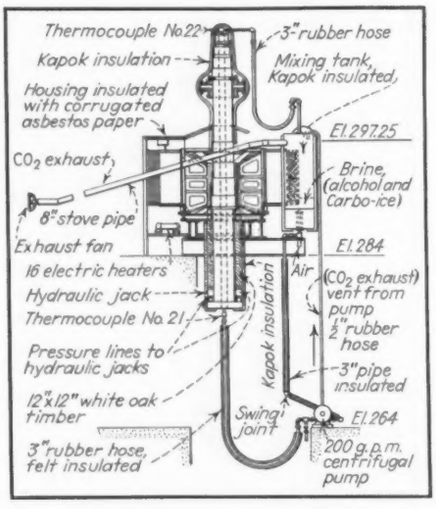
NOW The WATTHOUR METER





Shrink generator shaft with refrigerant to remove spider



Rotor was housed in an insulated chamber equipped with several space heaters of 10 kw.

Close beside, a 750-gal. steel tank 3.5 ft. in diameter and 11 ft. high was set up, insulated and equipped with coarse and fine strainers for carbo-ice. A connection was set up from the bottom of the tank to the bottom of the shaft through a 200-gal.-per-minute centrifugal pump. There was a return from the top of the shaft to the tank. Thirty-two thermocouples were used and two 75-ton hydraulic jacks exerted a thrust between shaft and rotor.

2. Simultaneous cooling of the shaft by water at about 4 deg. C.

3. Final rapid cooling of the shaft using alcohol and carbo-ice.

4. Quick application of large amounts of heat to the spider hub in case items 1 to 3 did not ease the shaft. Charcoal baskets were held in reserve for this purpose.

Five days were devoted to preliminary heating of the rotor. At the end of this time a temperature of 84 deg. C. was reached in the laminated irong ring, the hub was at 50 deg. C. and the shaft 28 deg. Thus a temperature difference of 22 deg. C. was attained between shaft and hub. Under these conditions a thrust of 200 tons did not move the shaft.

With 300 gal. of alcohol circulating in the cooling system at a temperature of 6 deg. C. and at 200 gal. per minute, 6 tons of carbo-ice on hand and two hydraulic jacks exerting 150 tons on the shaft, intensive cooling operations were started. About ½ ton of broken carbo-ice was put into the tank shown in the accompanying diagram. In about five minutes temperature of the refrigerant dropped 55 deg. C. and in ½ hour approximated the minimum attainable, namely,—72 deg. C. Within an hour the jacks had lost their pressure, indicating that the shaft had moved without use of local auxiliary heat. Within another hour the shaft was quite free and was lowered clear of the fitted portions.

The temperature difference between shaft and hub when the shaft first moved was 34 deg. C., and when a difference of 48 deg. C. had been reached the shaft was free. It is estimated that the shaft was reduced 18/1,000 in. in diameter by this treatment, according to an article in *The Bulletin* of the commission.

•

Temporary Portable Protection Barriers

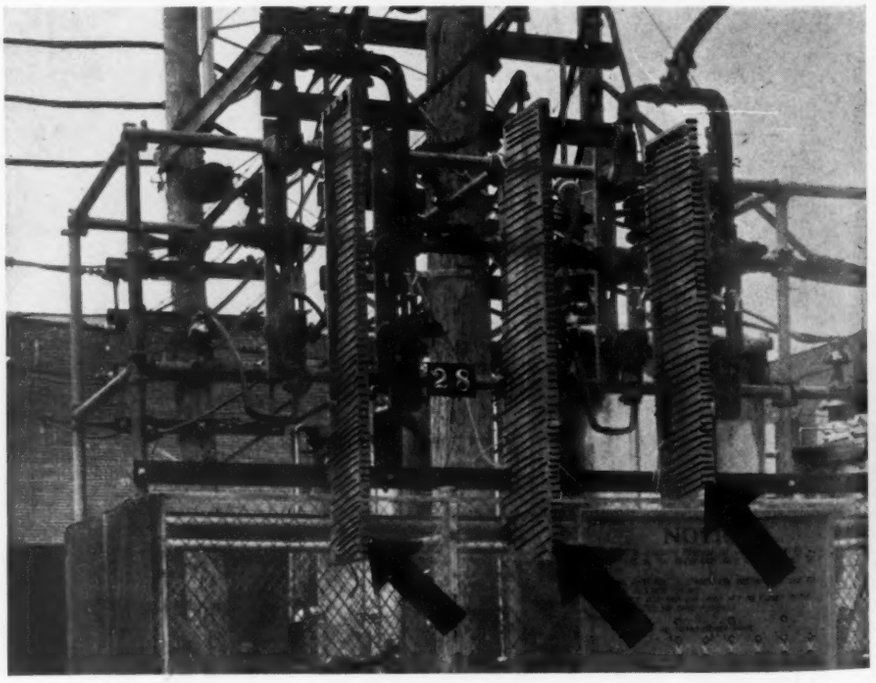
Unusual flexibility and convenience are features of the portable protection barriers here illustrated which are in use on the system of the Oklahoma Gas & Electric Company. They are employed in ordinary maintenance and construction work in and around substations to protect against accidental contact with energized equipment. The barriers are made of oven-dried spruce 1 in. thick treated with insulating varnish. Dimensions are 5 ft. x 16 in. Around the edges of each barrier is a frame of 2 x 2 in. spruce, fastened with wooden dowels for reinforcement. Spaced equally along the side edges of each barrier are five holes through which ropes are threaded for tying the barrier in place.

•

CleaningTransformers Before Repair

Distribution transformers removed from service at the central warehouse repair shop of the Union Electric Company of Missouri, St. Louis, are swung into the receiving room by means of a chain-fall hung from a track overhead and deposited on a duck board floor with a drain below. There a rubber-garmented employee gives each a thorough bath, scrubbing included, with a hot solution of trisodium phosphate. Covers are removed and the oil extracted with a suction hose.

The storage tank for the cleaning solution is located just below in the basement and the liquid is pumped up and flows back by gravity from the floor above. In the tanks are steam coils by which the solution is



Temporary barriers guard against accidental contact

R&IE *Indoor Switches*

LESS OPERATING RESISTANCE

Hi-Pressure Contact Jaw and Hinge eliminate large blade contact surfaces which cause friction when blade is operated in or out of contact, especially after standing idle.

LESS CURRENT RESISTANCE

Hi-Pressure Contacts at jaw and hinge have clean concentrated spot (in jaw) or line (in hinge) contact areas under pressure, which are more efficient, more positive and free from resistance.

LESS SPECIFICATION RESISTANCE

Hi-Pressure Contacts have been successful in giving years of trouble-free service under all conditions, making them desirable on switching equipment being specified daily.

ARE YOU GETTING THE ORIGINAL, PROVEN HI-PRESSURE CONTACT ON YOUR SWITCHING EQUIPMENT...?

STREAMLINED - for Effeciency and Appearance

RAILWAY and INDUSTRIAL ENGINEERING CO....GREENSBURG, PA.

In Canada—EASTERN POWER DEVICES, LTD., TORONTO

Table I—Failures on 2,300-Volt Transformers—1934, 1935, 1936

Cause	Number			Per Cent of Total Failures			Per Cent of Total Transformers on System		
	1934	1935	1936	1934	1935	1936	1934	1935	1936
Lightning	13	23	33	39.4	59.0	59.0	0.193	0.334	0.474
Old age	3	5	5	9.1	12.8	8.9	0.044	0.073	0.072
Overload	4	2	4	12.1	5.1	7.1	0.059	0.029	0.057
Defective	4	2	1	12.1	5.1	1.8	0.059	0.029	0.014
Sec. and service shorts	3	1	5	9.1	2.6	8.9	0.044	0.015	0.072
Building fires	2	2	....	6.1	5.1	.....	0.029	0.029	.....
Bushing failure	....	2	....	.....	5.1	.....	.....	0.029	.....
Primary lead broken	1	1	....	3.0	2.6	.....	0.015	0.015	.....
Flashover-snow	....	1	....	.....	2.6	.....	.....	0.015	.....
Tree fell on transformer	1	....	....	3.0	.....	.....	0.015	.....	.....
Undetermined	2	....	4	6.1	.....	7.1	0.029	.....	0.057
Customer trouble	....	....	2	.....	.....	3.6	.....	.....	0.028
Water in oil	....	....	1	.....	.....	1.8	.....	.....	0.014
Line crew	....	....	1	.....	.....	1.8	.....	.....	0.014
Total	33	39	56	100	100	100	0.49	0.568	0.803

Number of transformers on 2,300-volt system, Dec. 31, 1936 — 6,972. The average age of the 2,300-volt transformers that failed in service for the years considered is 16.2 years.

Table II—Failures on 6,900-Volt Transformers—1934, 1935, 1936

Cause	Number			Per Cent of Total Failures			Per Cent of Total Transformers on System		
	1934	1935	1936	1934	1935	1936	1934	1935	1936
Lightning	14	42	22	50.0	87.8	50.0	0.429	1.23	0.614
House fire	8	4	6	28.6	8.2	13.6	0.245	0.12	0.167
Sec. and service shorts	2	....	7	7.1	.....	15.9	0.061	.....	0.195
Broken bushings	1	1	....	3.6	2.0	.....	0.032	0.030	.....
Undetermined	3	1	4	10.7	2.0	9.1	0.093	0.030	0.112
Overload	....	....	3	.....	.....	6.8	.....	.....	0.084
Defective auxiliary equipment	....	....	1	.....	.....	2.3	.....	.....	0.028
Water in oil	....	....	1	.....	.....	2.3	.....	.....	0.028
Total	28	48	44	100	100	100	0.86	1.41	1.23

Number of transformers on 6,900-volt system on Dec. 31, 1936 — 3,581. The average age of the 6,900-volt transformers that failed in the years considered is 7.0 years.

heated. Leaving the reception room, the transformer enters the shop clean and dry and ready for the repair crew.

•

Recording and Using Line Troubles Data

By P. N. KENT
Kansas City Power & Light Company, Kansas City, Mo.*

One of the most valuable results obtained from the trouble record kept by the overhead system department of the Kansas City Power & Light Company is the anual summary of troubles on distribution transformers. Combined with data on field tests, this summary makes a report that is of great help in the loading and operation of the distribution transformer plant. Examples of the transformer data appear in the accompanying tables. Names of manufacturers are not given, but they are, of course, included in the record data and are an important consideration in the use of the report.

It will be observed that the average failure age of the transformers on the 6,900-volt system is considerably less than the average age of those on the 2,300-volt system. The two main contributing factors to this difference are: (1) Greater prevalance of lightning troubles in the more open country served by the rural or 6,900-volt lines. (2) The transformers of the rural system are on the average much newer than those on the 2,300-volt system as the rural system is a much newer development in the utility field.

Another set of data of interest and value is shown in the comparison of lighting failures vs. storms.

Year	No. of Thunderstorms per Weather Bureau	No. of Lighting Failures on Transformers 2,300 V.	6,900 V.	Total
1936	40	33	22	55
1935	53	23	42	65
1934	50	13	14	27

This table more clearly shows the greater percentage of lightning failures on the 6,900-volt or rural system. Although the number of transformers in service on the rural system is only half as great as the number in service on the 2,300-volt or city system, the number of lightning failures on the rural system is usually equal to and often greater than the number of failures on the 2,300-volt system.

The table shows a proportionally greater number of failures in 1935 and 1936 per number of lightning storms than in 1934. However, the storms in 1935 and 1936, though fewer in number, were of much greater intensity than those in 1934. This would account for the increase in the total number of transformer failures.

The transformer data presented here are typical of that available from the daily and yearly records kept by the company. However, it is only a small part of the total amount obtained and used for the purpose of improving the load, operation and protection of the transformers on the overhead system.

•

For Safety in Wire Stringing

When wires are strung in on lines that already carry a number of conductors it is sometimes difficult to keep the slack of the new wire from coming into contact with wires below. This hazard is avoided on the overhead system of the Oklahoma Gas & Electric Company by the use of the ladder guard shown here. The ladder is constructed of spruce, thoroughly oven dried and treated with insulating varnish.

The dimensions are the same as those for a standard ladder, with a length of 12 ft. and a width of 18 in.

Ladder holds up wire slack

The two rollers provided at each end prevent wear that would normally be encountered with stationary rungs. They are made of spruce, the entire ladder assembly having no metal parts.

* Sixth installment of a series from paper to Missouri Valley Electric Association.

Modernize Wiring" Campaign?

These messages, suitable for use in newspapers, direct-mail advertising or your own company publication, are being used by utility companies to interest manufacturers.

This advertisement is one of a series addressed to the industrial executive. It appears in Time, Business Week, and a large number of industrial magazines.

A number of utilities are finding it profitable . . . Anaconda will supply booklets, ads, other materials

SINCE the Anaconda "Modernize Wiring" program got under way a little over a year ago, many utilities have found it profitable to cooperate. We believe the movement is just gaining momentum.

One utility company which carried on a "modernize wiring" campaign developed over 450 leads. These were followed up by the power salesman in cooperation with the local wholesaler and electrical contractors. A number of new lighting and power installations were obtained, as well as numerous re-wiring jobs.

The two books shown here outline a definite approach for your salesmen. Costly losses now being suffered by industrial plants can be revealed by means of a *wiring survey*. These books show how to make that survey. They also show what to do to remedy the conditions found.

This program is sound economics. When an industrial plant gets full value for the power it buys, it will soon be in the market for more power. Use these books as a "door opener" to interest the industrial plants in your locality in an electrical modernization program. We will assist you by supplying books, forms for sales letters, material for ads, and complete directions for carrying on a campaign. A number of utilities are making use of our materials, why not you?

An Anaconda representative will be glad to discuss this program with you.

37555

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We should like a copy of your books and outline for a campaign.

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Company

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from mine to consumer

ales Offices in Principal Cities

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

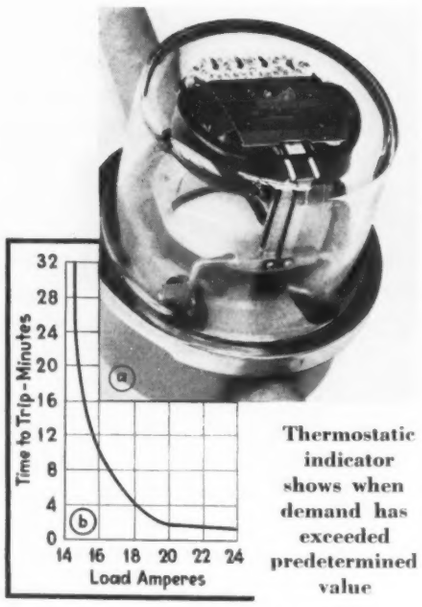
Tripped Flag on Meter Shows Load Demand

By E. L. KELLER
Supervisor Shop Meter Section,
Duquesne Light Company, Pittsburgh

Measurement of demand of customers in the lower brackets is a problem wherever consumption does not warrant the expense of a regular demand meter and yet the connected load may be in the demand class. On the other hand, a customer may sign a contract for a 1-kw. connection and later growth of business may raise his demand to 6 or 8 kw., and the fact that his meter is overloaded is not apparent unless picked up and reported by the meter reader.

These cases are by far the largest group of customers affected by sliding rates or demand charges, and in order to secure the information necessary to bill these customers properly some simple method of arriving at the approximate demand is necessary. In such cases the use of highly accurate block interval demand attachments are not necessary and their cost cannot be justified. The available conventional demand attachments are expensive and their maintenance cost is high. For this service the writer has developed and patented a thermally operated flag indicator which is adaptable to any existing kilowatt-hour meter. The device is compensated for ambient temperature and can be set to operate on any predetermined load. It also has the necessary time lag qualities necessary in demand measurements. The particular device described requires that the predetermined load must be on the meter for a continuous period of fifteen minutes before the indicator trips. The presence and operation of the device in the meter will not alter the meter accuracy.

This device can also be used as a demand attachment in that it will trip at a predetermined load. Where rates are based on demand blocks this device will show that the customer's demand is in excess of his contract.



Thermostatic indicator shows when demand has exceeded predetermined value

(a) Device mounted below meter element. (b) Indicator trips promptly on heavy demand.

Operation of the device is based on the principle of a thermostat. The meter current passes through a bimetallic strip and causes a slight deflection. When sufficient deflection is obtained the signal flag drops into view so that it can be readily observed. A set screw is provided for adjustment. The deflection is proportional to I^2R, and as R is constant there is a negligible deflection for small currents and a large deflection for high current values. The thermal strip never reaches extreme temperatures, hardly more than warm, and is so designed that it will carry enormous overloads. The device can be adjusted to trip at a value of current which would show the meter reader that the customer has attained sufficient load to warrant the demand attachment.

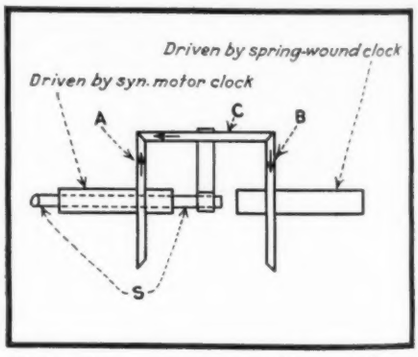
•

Devise Timing Scheme for Watt-Hour Meter

By G. R. SHUCK
Professor of Electrical Engineering
University of Washington, Seattle

A timing arrangement that combines the interruption-free features of a hand-wound clock with the accuracy and compactness of a synchronous electric clock has been devised for use with an experimental variable ratio watt-hour meter (ELECTRICAL WORLD, May 8, 1937, page 35) that registers at different rates during peak and off-peak hours.

Use of a synchronous clock alone



Dual drive arrangement for watt-hour meter timing device

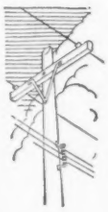
Gear A is driven by a hollow shaft and synchronous clock motor at a speed of two revolutions per day. Gear B is driven by an ordinary clock in the same direction (clockwise) at the same speed. The involute gear C meshed with both A and B rotates the shaft S at one revolution per day when either A or B rotates. The synchronous clock drives the timing mechanism during most of the time, but during power interruptions it takes up the duties. Gear B may be driven by the hour hand shaft of the clock.

BLUEPRINTS FROM A SPECIAL HANDBOOK

RURAL LINE—SINGLE-PHASE TRANSFORMER INSTALLATION

featuring

A NEW DEPARTURE IN PROTECTIVE EQUIPMENT



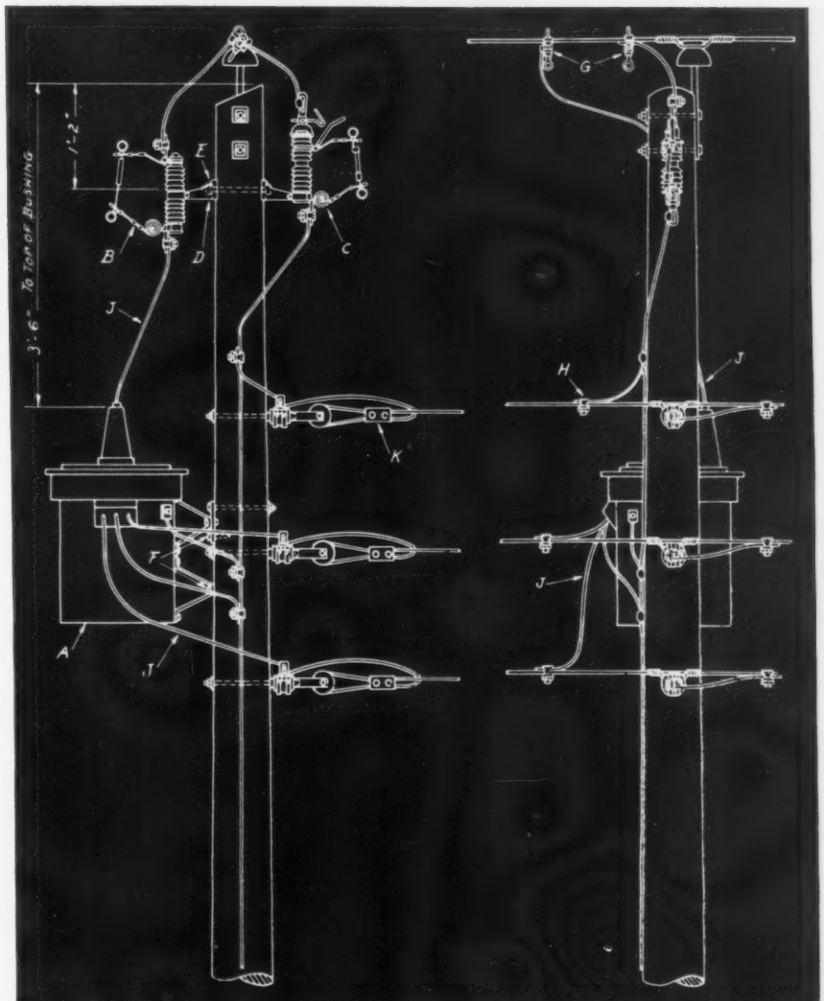
Where rural line extensions for rural electrification are made, we see this conventional system neutral quite generally adopted.

A single bushing type of distribution transformer is used and protected from overloads and short circuits by means of Kearney Trip-O-Link Switches. These are connected to the primary with rural-type Con-Nec-Tap Clamps.

Unnecessary blowing of fuses and protection of the transformer from lightning surge is accomplished by the installation of Trip-O-Gap Surge Arrestors which are connected directly to the primary with Con-Nec-Tap Clamps. Mechanical Dead Ends have been neatly made with Kearney Dead End Groove Clamps. Grounds are made with Kearney Clamp-Tites.

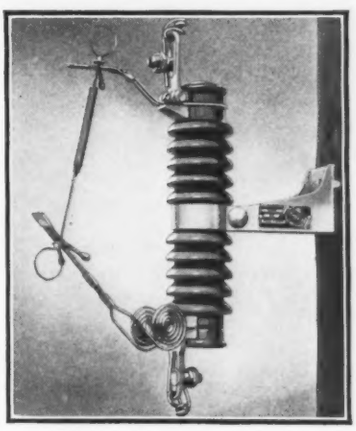
And here's another example of the complete adaptability of Kearney Equipment for modern constructions.

Reprints of this ad and others —"Blueprints from a Special Handbook," will be sent on request.



ITEM	NO. REQ.	MATERIAL	ITEM	NO. REQ.	MATERIAL
A	1	TRANSFORMER, COORDINATED CONVENTIONAL	F	2	LAG SCREW ½" x 4"
B	1	KEARNEY TRIP-O-LINK	G	2	KEARNEY TAP OFF CLAMP
C	1	KEARNEY TRIP-O-GAP	H	9	KEARNEY CON-NEC-TITES
D	1	THRU BOLT ⅝" REQ'D LENGTH	J		LEADS
E	1	WASHER 2½"x2½"x3/16", ⅝" HOLE	K	3	KEARNEY PARALLEL GROOVE CLAMP

Kearney Trip-O-Link fuse switches are guaranteed to give you satisfactory performance on rural constructions and similar jobs where capacities are limited—try them and you'll like them.



The Mark of JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *Quality Products*

DESIGNED AND MANUFACTURED BY

JAMES R. KEARNEY CORPORATION: 4236-42 CLAYTON AVE., ST. LOUIS, MO.

was not considered advisable because of the possibility of a power interruption throwing the timing arrangement off the off-peak schedule. Difficulty in constructing a hand-wound clock with a 35-day movement made some combination of the two schemes desirable.

The arrangement shown in the accompanying illustrations permits an electric clock to be used to drive the timing mechanism the majority of the time. During periods when the power is off a mechanical clock takes up the burden of driving the mechanism; otherwise the clock does not unwind.

The mechanical time clock is forced to be stationary when the electric clock is operating by a very small magnet in series with the clock circuit. This magnet stops the balance wheel of the clock when power is on and releases it during periods of interruption.

•

Transients Stamp Time When Photographed

By M. A. RUSHER

General Engineering Laboratory, General Electric Company, Schenectady

In stations where attendants are always on duty the matter of recording the time of system disturbances has not presented any great difficulties, but since power systems are interconnected so extensively a more accurate record of this time has become important. In other stations, which are automatically operated, no such record has been obtainable except from recording instruments, and these have a record speed which is too low to give accurate determinations of time unless

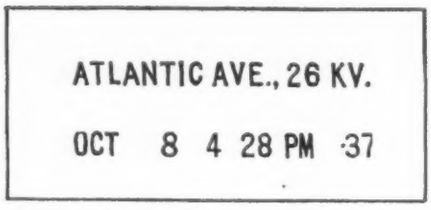


Fig. 2—Record from time stamp, also showing record from fixed stamp for station identification

Time stamp mechanism is inserted between conventional automatic oscillograph and the receiving record paper holder. Where several automatic oscillographs are used on different branches of the same system some power companies also find it desirable to add the name of the station along with the date for future identification of the record.

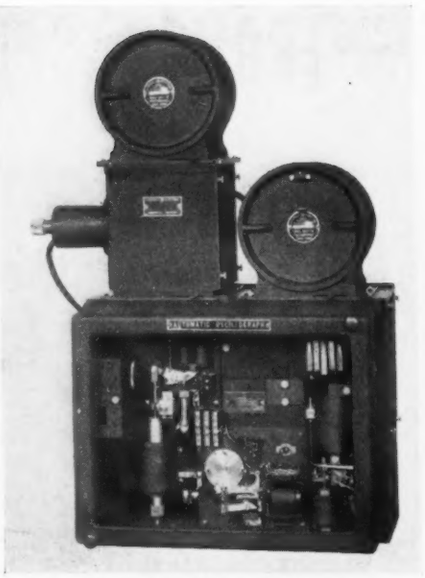


Fig. 1 — Automatic oscillograph has time stamp added

they are given a comparatively large travel of the recording pen.

The most recent improvement which has been provided for use with the automatic oscillograph is an attachment which automatically stamps the time on the back of each oscillogram. This is shown mounted on the automatic oscillograph in Fig. 1. It consists of a train of gears and record wheels driven continuously by means of a Telechron motor. It is provided with a stamping solenoid, energized by the closing of the same contacts which reset the starting relay of the oscillograph, which stamps the time approximately two inches after the beginning of the oscillogram. By stamping on the back of the paper a permanent record is obtained which is not defaced by the developing and fixing process. This time stamp requires no attention except for resetting once a month and meets all the requirements of the automatic substation as well as the requirements of those substations which have attendants.

Even if the records should be left in the receiving holder for long periods of time, which is usually not the case, each oscillogram, when this time stamp is used, will have a record of the year, month, date, hour and minute of each operation as well as an A.M. or P.M. indication. If the A.C. source of power which operates the time mechanism should fail during a disturbance the stamp will still record the time at which the disturbance began.

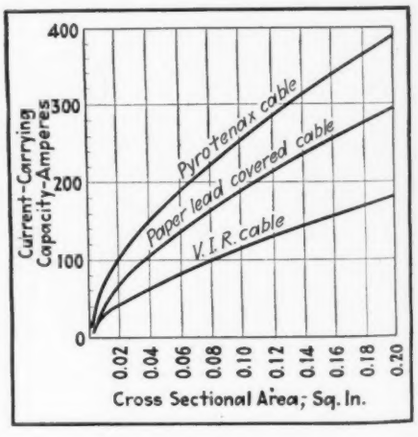
A sample record is shown on the lower line of Fig. 2.

Magnesia Insulation for New Power Cable

A new 600-volt magnesia-insulated power cable is attracting attention in England because of its high insulation resistance, mechanical strength and current carrying capacity.

In manufacturing this cable small pressed blocks of magnesia, complete with holes to take the conductors, are heated to drive off all physically and chemically combined moisture and then fed into the copper tube that forms the sheath of the cable. Neutral gas is passed through the copper tube while it is being filled to prevent oxidation of the copper from the heat of the magnesia blocks. Copper conductors are then fed through the holes in the magnesia blocks. The filled tube is next drawn out to two or three times its original length, at the same time reducing the cross-section of the cable and consolidating the insulation. As the cable becomes hardened with drawing it is passed through a continuous furnace to soften the copper for further drawing.

"Pyrotenax" cables for 600 volts have an insulation thickness of 0.06 in. and withstand a voltage of 2,500 for one minute before leaving the factory.

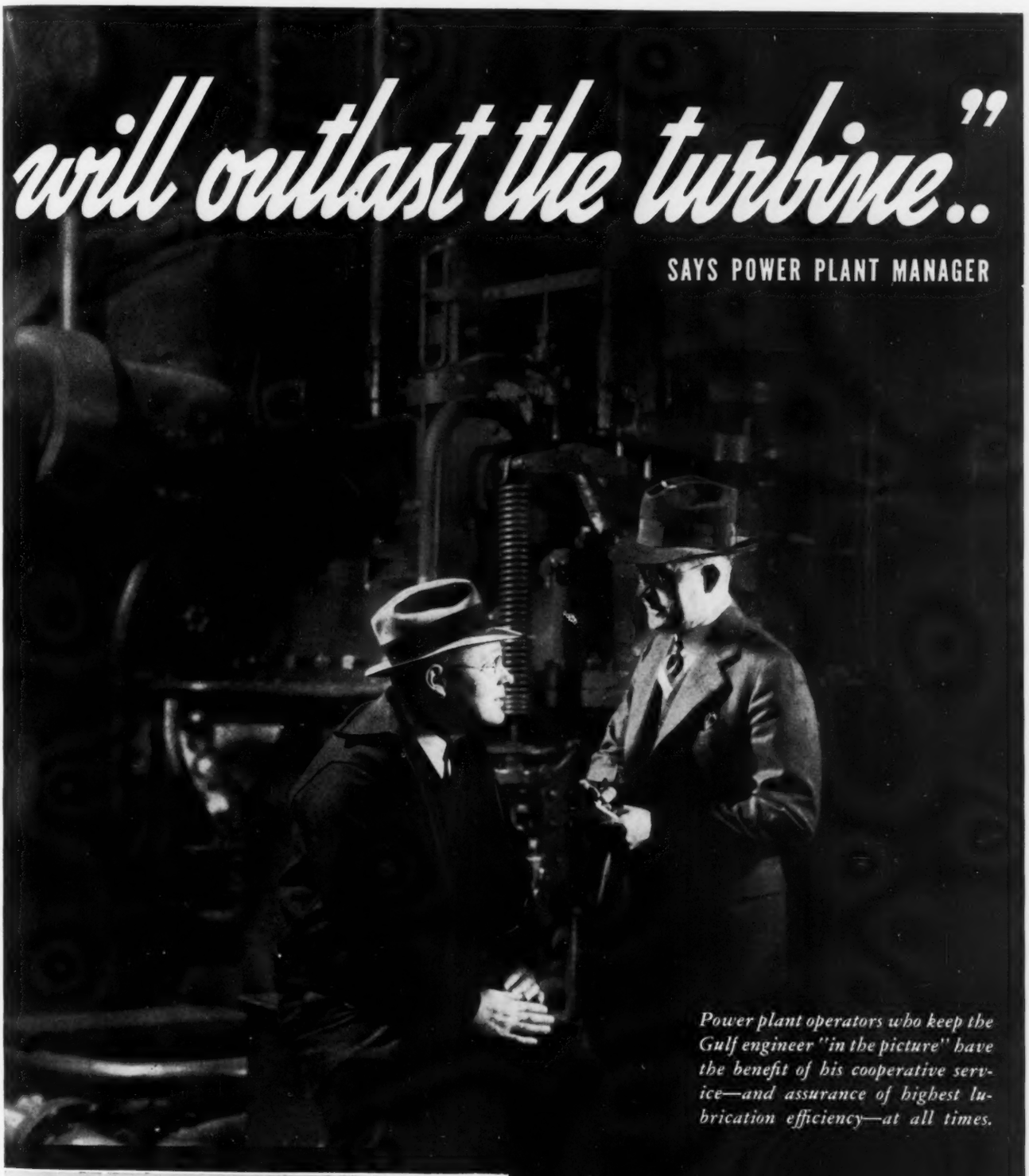


Comparative current carrying capacity of magnesia-insulated cable

Test shows that the cables frequently have an insulation resistance of 7,000 megohms per mile. A report in the London *Electrician* states that exposed ends of this cable can be immersed in water for several days without moisture penetrating the insulation more than a few inches. This is said to be due to the extreme compactness of the insulation, even though it is hygroscopic by nature.

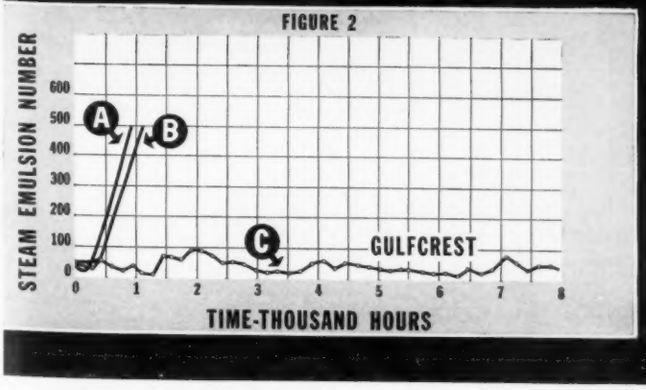
will outlast the turbine.."

SAYS POWER PLANT MANAGER



Power plant operators who keep the Gulf engineer "in the picture" have the benefit of his cooperative service—and assurance of highest lubrication efficiency—at all times.

FIGURE 2



GULF INDUSTRIAL LUBRICATION

MAKERS OF GULF NO-NOX ETHYL GASOLINE AND GULFPRIDE OIL

Fig. 2 shows the effect of accelerated oxidation at 210° F. in the presence of copper, iron and water on the *steam emulsion numbers* of three different turbine oils. Curve C—representing Gulfcrest oil—shows the marked superiority of this Alchlor treated lubricant (This test was made in the laboratory of the Gulf Research & Development Company.)

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

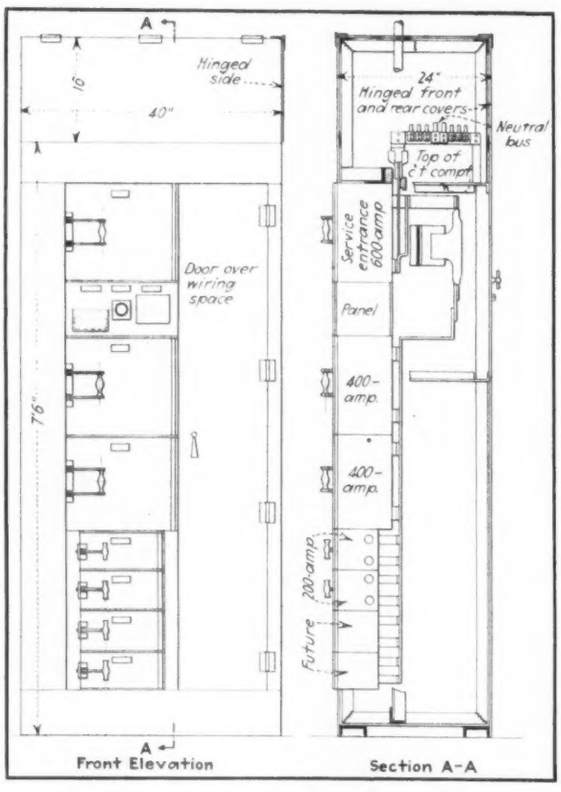
Safety Switches Make Lighting Switchboard

By R. B. STRASSEN
Electrical Engineer
Owens-Illinois Can Company, Chicago

By making use of commercially available equipment usually employed in another way, a rather different and very satisfactory switchboard for lighting service metering and distribution was constructed for use in the Clearing (Chicago) plant of the Owens-Illinois Can Company. The board—steel cubicle type—was built by the Gus Berthold Electric Company, Chicago, on a design furnished by the writer.

As may be seen from the accompanying elevation and section drawings, the board is the usual cubicle with incoming main and outgoing circuits at the top. The cubicle is amply dimensioned to afford plenty of room to work inside it. The top chamber, where the main and circuit terminals are, is easy of access through full-area hinged doors, front, back and sides. The next lower chamber contains the current transformers for the utility company meter and is accessible from the back through a door which is utility sealed. The front of this chamber is occupied by the 600-amp. service switch. Below this are the flush-mounted switches for the circuits at the bottom. A door on the front of the cubicle opens on the wiring space for the switches, but the back is closed by removable panels.

The particular feature of this cubicle is the assembly in it of switches ordinarily used in closed-front branch distribution panels, not on open-front switchboards. They are Square D "Saflex" units with fuses and door-opening breaks. The use of these standard commercial units effected a considerable economy in the construction of the board.



Lighting service and distribution cubicle of novel design

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Furnace Speeds Steel Deliveries

By R. L. BAKER
Metropolitan Edison Company, Reading, Pa.

Because it was feared that the product manufactured by a large steel mill customer might ultimately lose out in competition with other metals, the power sales department in co-operation with one of the large equipment manufacturers, pointed out to the customer certain advantages of producing a part of his steel requirements in an electric furnace, in the hope that with the large amount of scrap available, steel could be produced in competition with the market.

Advantages accruing to the customer were, however, other than the comparative cost of purchased steel. It was found that small lots with varying specifications could be promptly delivered, whereas the delay, without a large and costly stores inventory, might be weeks or even months if supplied by other steel companies.

A 3-ton electric furnace was installed and the original assumption, that the installation of this furnace would lead to the manufacture of a better product, has proved true, since the customer has now found it advantageous to bid on certain better grades of steel products which he heretofore could not consider. The competitive cost of melting electrically was not as important

as the other advantages which this customer will undoubtedly procure in the future.

•

Automatic Servicing for Large Batteries

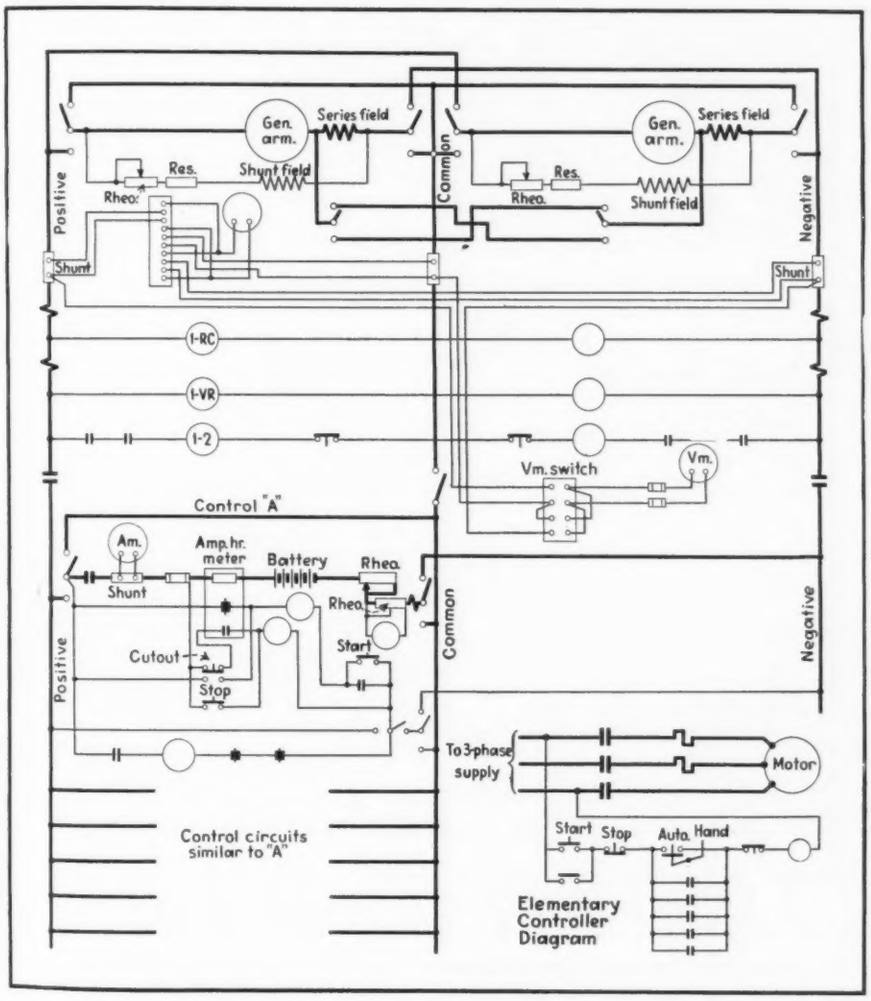
Automatically controlled conversion equipment of special design permits servicing of Edison batteries ranging from 20 to 1,000 ampere-hour capacity at the San Francisco service plant of the Edison Storage Battery Supply Company. Regular daily requirements call for the charging and discharging of a variety of cell combinations. Since a major portion of the charging and discharging operations are carried out at night, with no attendant present, full automatic control is indispensable.

Two three-unit motor-generator sets furnish power for all operations. One set incorporates two 10-kw., 70-volt, two-wire d.c. generators which serve six automatic charging circuits. The second set of two 3-kw., 24-volt, two-wire d.c. generators serves three automatic battery-charging circuits. Each set of two generators operates independently and uses three charging buses. Selector switches permit the two generators of either set to be connected in series to form a conventional three-wire charging circuit. If desired one or both generators may be connected between center bus and either outside bus to provide double capacity on a two-wire basis.

Charging between the two outside buses, or between either outside bus and the center bus, is possible on each charging circuit. The automatic control shown in the accompanying diagram can be switched to either side of a given charging circuit as desired. The charging operation on each individual circuit can be terminated automatically at any desired point and the motor-generator sets shut down automatically when the last associated charging circuit cuts off. An ampere-hour meter is connected in each of the charging circuits which has contacts so connected that one set will terminate the charge when complete.

Automatically controlled discharging may also be set up on all circuits. Discharge can be carried out independent of charge; that is, one or more circuits may be discharged while others are charging. An independent closed circuit connection is utilized for each discharge set up. Contacts on an ampere-hour meter in each circuit terminate the discharge after a given number of ampere-hours have been drawn from the battery.

This system designed by the Westinghouse Electric & Manufacturing Company, is said to provide an efficient, flexible and practically foolproof servicing installation which meets a range of conditions not regularly found in the electrical field.



Automatic control for 20-kw., three-unit M.G. set and its six associated circuits for battery charging and discharging

A reverse current relay in each of the two outside buses opens and disconnects the genrator from the batteries. When voltage again builds up to a sufficiently high value to continue charging the relay will again close and charging continue. Overload relays are also provided in each of the two outside buses and in the motor circuit. In the event of overload, depending upon its location, the relay in the overloaded circuit will trip and keep the circuit open until the fault is corrected and the relay reset. Fuse protection is provided in each battery circuit and in the voltmeter circuits.

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Tilt Tube Reduces Waste Paper Losses

By M. H. GERHARD
Power Sales Engineer
Consumers Power Company, Kalamazoo, Mich.

Waste resulting from the buckling of oil paper in a printing press operation at the Saniwax Paper Company, Kalamazoo, Mich, cost this company 90 cents a day. Buckling occurred as the paper came from one roll, passed through the press and rolled up on another roll, and was caused by the irregularity of the rolled paper. When buckling took place considerable paper was usually destroyed before the press could be stopped.

A power engineer was called in and at his suggestion a mercury contact tube was so attached to a lever resting on the sheet of paper that when the paper broke the mercury tube changed position, broke the relay control circuit and stopped the motor operating the press.

Although this arrangement did not stop the entire loss, it did make possible a saving of approximately $12 a month.

$2 THE $5,000 FIRST PRIZE

ALL RIGHT—WHO *GETS*

DON'T LET THIS HAPPEN TO YOU!
ONE CENT NEVER BOUGHT SO MUCH COLD AND ICE!
Kelvinator
THE CHAMPION ICE-MAKER
HERE'S WHERE YOU CAN SEE THIS MIRACLE OF COLD-MAKING TOMORROW
4-COLOR PAGES
Brilliant, smashing ads . . . running continuously in SATURDAY EVENING POST . . . COLLIER'S . . . THIS WEEK . . . AMERICAN WEEKLY . . . and other powerful magazines!
PROVES
E-MAKER!
VINATOR'S
LD-MAKING!

BREAKING THE GREATEST STORY IN REFRIGERATOR HISTORY!

You have never seen refrigerator ads like the tornado Kelvinator is turning loose for 1938. There's plenty in them to get excited about!

They're in full color . . . they're full pages . . . they run continuously (and we mean continuously) in the most popular, most influential magazines in the country.

They've got new "interest getting" power that starts with the first word and never lets up. They've got a new way of glorifying a beautiful refrigerator in pictures . . . and telling a whole sales-story in pictures . . . that will be one of the big wallops of the year.

Then there's a smashing, fighting campaign of power-house space in Key Cities . . . listing dealers.

BUT THAT'S ONLY A SMALL PART OF IT! There's a complete, balanced, carefully-planned, "tailored to order" program for *each individual dealer's local use.*

And every detail, every word and line of it is sharp-pointed fighting, SELLING HELP—right on the target of making sales *NOW!*

It's so big and so good that you'll *kick* yourself all year if you don't find out about it . . . and get in on it . . . *right now!*

Gangway for the 1938 **KELVINATOR**

THE $5,000 FIRST PRIZE

AND THE 7 OTHER PRIZES IN THIS $8,000 KELVINATOR CONTEST THAT'S OPEN TO THE WHOLE ELECTRIC APPLIANCE INDUSTRY?

FULL DETAILS HERE!

Everyone in the industry can get in on it—presidents or office boys—ANYONE who is not on the Kelvinator office or factory payroll. IT'S WIDE OPEN!

There's something mighty big happening at Kelvinator . . . *again* this year! So big we want every person in the industry to know and understand it from A to Z. That's the purpose of this $8,000 contest—with its $5,000 first prize.

Now for the facts you need to get in on it . . . simple . . . straight-forward . . . no red tape nor strings.

First—See the 1938 Kelvinator line, and learn about the 1938 Program, through your nearest Kelvinator distributor.

Second—Decide which of *the following three factors will* be most helpful to Kelvinator Dealers in 1938 . . . and tell, in a letter of 50 words or less, why you think so.

1 THE PRODUCT—12 beautiful new 1938 models . . . sealed, silent Polar Power unit so amazingly efficient and economical it delivers 72 big ice cubes for 1c (figured at the national average rate for electric current) . . . sensational new Speedy-Cube ice release . . . remarkable, exclusive new shelf adjustability . . . and a score more great selling features.

2 1938 ADVERTISING PROGRAM—tremendous, continuous full-page, four color campaign in foremost magazines . . . tremendous "key city" campaign, *listing dealers* . . . and individually tailored local program for *every* Kelvinator dealer.

3 1938 SALES-CLOSING PROGRAM—tested and proved sales-training materials . . . door openers . . . carefully planned seasonal selling-campaigns . . . generous customer financing-plans . . . and plenty more!

$5,000 FOR FIFTY FRANK WORDS!

See the products and get the facts from your Kelvinator distributor.

Use your own good judgment as to which of the above factors in the whole mighty program will add most to its success.

Then tell us, in a letter of 50 frank words or less, why you figure it that way. Doesn't matter a bit which factor you think counts most—or whether or not that factor actually does turn out to be most important.

We're after frank opinions . . . good business thinking by the people in our own industry. And an office boy's letter will be read and considered on absolutely even footing with the letter from a president of a company.

THE PRIZES will be: $5,000 first prize; $1,500 second; $500 third; and five prizes, fourth to eighth inclusive, of $200 each. Substantial enough to be worth trying for, in any man's time.

THE RULES are just three: anyone in the electrical appliance industry can compete except people on the Kelvinator office or factory payrolls; letters must be limited to 50 words; and all letters must be postmarked before midnight, January 30, 1938, addressed to *DEPT. K, Kelvinator, Division of Nash-Kelvinator Corporation, Plymouth Road, Detroit, Mich.*

There you are. Come one, come all!

SEE THE NEW KELVINATORS AND GET FULL 1938 PROGRAM STORY FROM YOUR NEAREST KELVINATOR DISTRIBUTOR!

LIST OF KELVINATOR DISTRIBUTORS

Albany, N. Y.	Albany Garage Co., 28 Howard St.
Albuquerque, N. M.	Raabe-Mauger Co., 112 W. Copper St.
Amarillo, Tex.	Amarillo Hdwe. Co., 506 Tyler St.
Atlanta, Ga.	Graybar Elec. Co., Inc., 167 Walton St., N.W.
Baltimore, Md.	Nash-Kelvinator Corp., 1426 N. Charles St.
Bay City, Mich.	George F. Dent Co., 210 Fifth Ave.
Birmingham, Ala.	R. P. McDavid & Co., 2104 First Ave., No.
Boise, Idaho	Walker Electric Co., 10th & Grove Sts.
Brooklyn, N. Y.	E. A. Wildermuth, 1102 Atlantic Ave.
Buffalo, N. Y.	Appliance Wholesalers, Inc., 320 Franklin St.
Burlington, Vt.	G. S. Blodgett Co., Inc., 190-200 Bank St.
Cambridge, Mass.	The Eastern Co., 620 Memorial Drive
Casper, Wyo.	Casper Supply Co., 444 S. Center St.
Chicago, Ill.	Nash-Kelvinator Corp., 2451 So. Mich. Ave.
Cincinnati, Ohio	Graybar Elec. Co., Inc., 310 Elm St.
Clarksburg, W. Va.	Williams Distributing Co., 406 N. Sixth St.
Cleveland, Ohio	Graybar Electric Co., 1010 Rockwell Ave.
Columbus, Ohio	Pixley Electric Supply Co., 129 Chestnut St.
Dallas, Texas	Graybar Electric Co., Inc., 400 S. Austin St.
Davenport, Iowa	The Elec. Equipment Corp., 116-118 E. First St.
Des Moines, Iowa	Sidles Co., 118 Tenth St.
Detroit, Mich.	Nash-Kelvinator Corp., 4809 Woodward
Erie, Pa.	Winter Co. of Erie, 1015 State St.
Fresno, Calif.	Devlin Drew Co., 718 F Street
Gastonia, N. C.	Moore & Stewart, Inc., 105 E. Franklin St.
Green Bay, Wisc.	Morley-Murphy Co., 112-14 Washington St.
Greenville, N. C.	Carolina Sales Corp., Third & Cotanche Sts.
Hagerstown, Md.	Bohman-Warne, Inc., 16 Summit Ave.
Helena, Mont.	Modern Utilities Co., Fuller & Lawrence Sts.
Henderson, Ky.	Lambert-Grisham Co., Inc.
Houston, Texas	Straus Bodenheimer Co., 1510 Preston Ave.
Huntington, W. Va.	Emmons Hawkins Hdwe. Co., 1028 Third Ave.
Indianapolis, Ind.	Kiefer-Stewart Co., 141 W. Georgia St.
Jacksonville, Fla.	Graybar Electric Co., Inc., 2302 Main St.
Kalamazoo, Mich.	North Davis, Inc., 439 Portage St.
Kansas City, Mo.	Richards & Conover Hdwe., 5th & Wyandotte Sts.
Knoxville, Tenn.	East Tennessee Elec. Co., 612 E. Depot St.
Lancaster, Pa.	Landis Electric Shop, 121 N. Duke St.
Lansing, Mich.	Garlock Sales Co., 105 W. Washtenaw Ave.
Lincoln, Neb.	Sidles Co., 1228 P Street
Little Rock, Ark.	555 Incorporated, Broadway & Second
Long Island City, N. Y.	Nash-Kelvinator Corp., 27th St. & Pearson Pl.
Louisville, Ky.	Graybar Electric Co., Inc., 626 6th St.
Memphis, Tenn.	Arthur Fulmer, 260-270 Monroe Ave.
Miami, Fla.	Graybar Elec. Co., Inc., 68 N. E. 20th St.
Milwaukee, Wisc.	Morley-Murphy Co., 424 N. Plankinton Ave.
Minneapolis, Minn.	Graybar Electric Co., Inc., 413 S. Fourth St.
Newark, N. J.	Krich-Radisco, Inc., 422-43 Elizabeth Ave.
New Britain, Conn.	Rackliffe Bros. Co., Inc., Park & Bigelow Sts.
New Orleans, La.	C. T. Patterson Co., Inc., 800 S. Peters St.
Norfolk, Va.	Tidewater Electric Co., 127-135 E. Olney Rd.
Omaha, Neb.	Sidles Co., 502 S. 19th St.
Pensacola, Fla.	Pensacola Hardware Co.
Peoria, Ill.	Marquette Appliance Co., 800 S. Wash. St.
Philadelphia, Pa.	Raymond Rosen & Co., N.W. Cor. 31st & Walnut
Phoenix, Ariz.	Electrical Equipment Co., 424 N. Central Ave.
Pittsburgh, Pa.	C. R. Rogers Co., 5434 Penn Ave.
Portland, Ore.	Appliance Wholesalers of Ore., 123 N.E. 3rd Ave.
Poughkeepsie, N. Y.	Poucher, Wood & Wallin, Inc., 407-9 Main St.
Providence, R. I.	Post & Lester Co. of R. I., Inc., 89 Broadway
Richmond, Va.	Gathright's, Inc., 416 E. Grace St.
Roanoke, Va.	Thurman & Boone, Inc.
Roswell, N. M.	Mabie Lowrey Hdwe. Co., 115 N. Main St.
Salt Lake City, Utah	Flint Distributing Co., Box 1470
San Antonio, Texas	Southern Equip. Co., Cor. Villita & Navarro
San Diego, Calif.	San Diego Standard Elec Corp., 1407 Columbia
San Francisco, Calif.	H. R. Basford Co., 425 Second St.
Savannah, Ga.	M. Wilensky & Son, Inc., 223 E. Broughton St.
Seattle, Wash.	Graybar Electric Co., Inc., King & Occidental Sts.
Sioux City, Ia.	M. H. Kirchbaum, 417 W. 3rd St.
Sioux Falls, S. D.	Tri-State Electric Co., 407 E. Eighth St.
South Bend, Ind.	Radio Equipment Co., 213 W. Jefferson Ave.
Spokane, Wash.	Tull & Gibbs, Inc., First & Wall Sts.
Springfield, Mo.	Ozark Motor & Supply Co., 308-19 S. Jefferson
St. Louis, Mo.	Graybar Electric, Inc., 1220 Spruce St.
Syracuse, N. Y.	Graybar Elec. Co., Inc., 327 North West St.
Tampa, Fla.	Graybar Electric Co., Inc., 416 Ella Mae St.
Toledo, Ohio	V. J. McGranahan Dist Co., 1702-04 Madison St.
Welch, W. Va.	Jones Cornett Elec. Co.
Wheeling, W. Va.	Earle Rogers Co., Main & 12th Sts.
Williamsport, Pa.	Williamsport Auto Parts Co., 241 W. Third St.
York, Pa.	The Careva Co., Inc., 145-47 W. Market St.
Youngstown, Ohio,	Stambaugh-Thompson Co., 114-118 W. Fed. St.

The Champion Ice Maker!

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

50 Foot-Candles for Chain Store Offices

By L. C. TWICHELL
Supervisor Lighting Service Division
Rochester Gas & Electric Corporation

Recently it became necessary, because of expanding business, to provide more office space at the headquarters of Neisner Brothers, Inc., Rochester, N.Y. The executives of this progressive and growing chain of more than one hundred 5-cent to $1 stores already recognized that better working conditions for their employees resulted in better work. They kept this in mind when they took over this additional street floor area, 36 ft. wide and 160 ft. deep, at 45 East Avenue.

Recognizing that the work of their staff was largely visual, careful study was given to the design of an adequate lighting system. After some thought it was decided to go ahead with the installation of only one fixture to each bay of 18x20 ft. This avoided a multiplicity of fixtures on the ceiling and took advantage of the better efficiency of larger lamps. Despite the comparatively wide spacing of fixtures a very uniform distribution of light was obtained over the area occupied by the desks.

Luminous bowl indirect Westinghouse "Magnalux" fixtures with a basic diameter of 24 in. were suspended 46 in. below the 14-ft.-6-in. ceiling. Each fixture was equipped with a 1,500-watt inside frosted PS lamp.

New wiring and outlets were necessary for the installation. This part of the problem was nicely handled by the use of No. 10, two-conductor "Ovalflex," channeled into the ceiling and plastered over. With one lamp per circuit, voltage conditions are excellent. The initial average artificial illumination on the desk tops was 50 ft.-candles. This began to fall off 3 ft. from the side walls. This high efficiency resulted from the combination of the white ceiling, an efficient fixture and the initial high-lumen output of the 1,500-watt lamp.

The first impression gained on entering this room is one of great visual comfort. This reaction is borne out by the enthusiastic approval of the office manager and staff after several weeks under this lighting. There is no ready measure of the output of this office, but the office manager is satisfied that the effect of this lighting in increased employee comfort and corresponding efficiency far outweighs its cost. In this connection it is interesting to know that the cost of current for lighting this room is only 1 per cent of the payroll cost of those employed therein.

Workers in Neisner Brothers, Inc., offices have desk-top illumination of 50 ft.-candles provided by 24-in. "Magnalux" basins with 1,500-watt lamps

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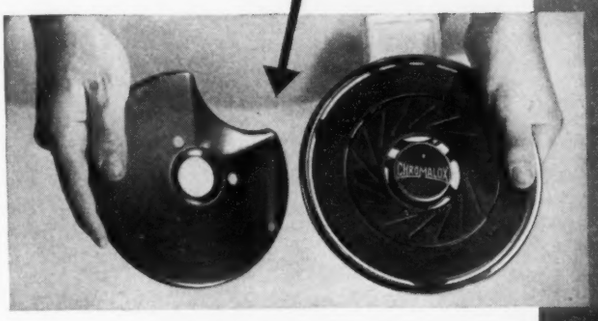
Kitchen Planning Goes Co-operative

Contrary to the general practice in which the utility carries on kitchen-modernizing activities, the kitchen-modernizing program in the Spokane, Wash., area is a co-operative activity financed by a number of businesses interested in home modernization.

There are 86 members, including architects, banks and finance companies, building-supply houses, wholesale and retail electrical stores, mill and

The Whole Trade's Selling...

...both kinds of MONEL



(ABOVE) *Ebonized Monel deflector, now standard on Chromalox Super-Speed closed cooking units. This new deflector resists heat, does not discolor or become spotty.* (RIGHT) *Crawford Monel-topped range manufactured by Walker & Pratt Mfg. Co., Watertown, Mass. This model available with Monel top only. The Chromalox Super-Speed Range Units are equipped with Ebonized Monel deflectors.*

The added convenience, plus smart appearance, make a strong appeal to modern housewives

PUT this new Crawford range on your showroom floor—and you'll quickly see customers attracted by its silvery top of Monel.* Tell any range prospect that this same metal – dressed up in a new coat – now brings *added* convenience, and you'll be still further on your way toward another sale. Here's why:

1. Thousands of smart housewives the country over know that Monel brings lasting beauty to the top of any range. They know, too, that Monel's silvery lustre is lasting – safeguarded by the freedom from rust, and heat and corrosion-resisting qualities of this strong, tough metal. And, as National Advertising constantly tells over ten million prospects, Monel's appearance *improves* with everyday use and cleaning – takes on added lustre as the years go by.

2. Now, to these advantages, Ebonized Monel adds another. Accepted as standard for deflector pans on the famous Chromalox super-speed closed cooking units, this black, shiny, Ebonized Monel brings new convenience. As tightly adherent to the metal as ink to paper, the glossy, jet-black coat of Ebonized Monel resists heat – does not discolor or become spotty.

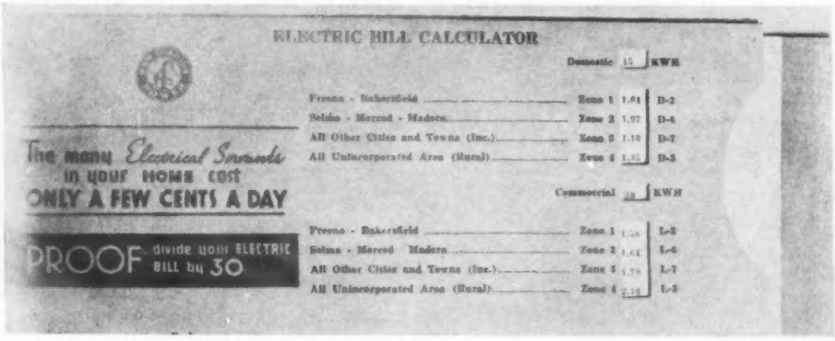
When demonstrating Monel-topped ranges, demonstrate the Chromalox units, too. Lift one out and show your prospect the attached deflector pan of Ebonized Monel. Remove this pan—and show how easily it can be wiped clean – how the black, shiny metal means an end to spotting, discoloration, cracking and chipping. Write for further information. Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.

• • •

*Monel is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. This alloy is mined, smelted, refined, rolled and marketed solely by International Nickel.

TO EXPEDITE RESIDENTIAL, COMMERCIAL RATE CONTACTS


ELECTRIC BILL CALCULATOR
Domestic 15 KWH
Fresno - Bakersfield Zone 1 1.01 D-2
Selma - Merced - Madera Zone 2 1.07 D-6
All Other Cities and Towns (Inc.) Zone 3 1.10 D-7
All Unincorporated Area (Rural) Zone 4 1.15 D-8
Commercial 50 KWH
Fresno - Bakersfield Zone 1 1.28 L-2
Selma - Merced - Madera Zone 2 1.44 L-6
All Other Cities and Towns (Inc.) Zone 3 1.70 L-7
All Unincorporated Area (Rural) Zone 4 2.10 L-8
The many Electrical Servants IN YOUR HOME COST ONLY A FEW CENTS A DAY
PROOF divide your ELECTRIC BILL by 30

San Joaquin Light & Power Corporation has distributed this simple slide-rule "bill calculator" to all public contact employees for use in informing its customers correctly and quickly as to cost of service in the various rate zone areas. It includes both domestic and commercial lighting schedules, the reversible insert covering a wide range of kilowatt-hour use. Devised by an employee primarily for use by meter readers and service men, the calculator has proved so useful that its distribution has been extended to all employees who, in line of regular duty, contact the customer.

lumber dealers, real estate firms and other similar operations. As set up the step-saving kitchen program is an outgrowth of the better housing committee of the Spokane Chamber of Commerce which served in the early days of the Federal Housing activity as local representative of that organization.

In expanding that committee to take over the kitchen-planning program the Washington Water Power Company played an important part in the new operation. Because the company saw the advantages of having a disinterested organization promote kitchen modernization, it agreed to support the activity to the extent of one-third of the total budget of $900 per month set up for the step-saving kitchen program operation. The personnel of the organization includes a manager, his secretary and a kitchen designer who operate from a central office in Spokane. One objective of the program is to have as many planned kitchens installed in local stores as possible that the women of the Inland Empire may view first-hand the advantages of scientific home planning. At present there are twelve such kitchens installed in various Spokane stores.

When a prospect comes in, or a member calls to have the consultant or designer go to the customer's home, steps are taken to provide recommendations for the modernization of the particular kitchen. A sketch of the new kitchen is planned, drawn up and colored and an estimate of the cost prepared. This sketch is then returned to the member sending in the prospect, or taken to the prospect as directed by the member originally submitting the business. In this way the members who develop prospects are protected and the result is to keep all members of the activity on the alert for new prospects.

Advertising, cooking schools and radio announcements are bringing the story of the step-saving program to the housewives of the area. It is expected that several hundred designs will be completed by the end of the year and, if the present experience is a criterion, a large percentage of these designs will be converted into actual installation.

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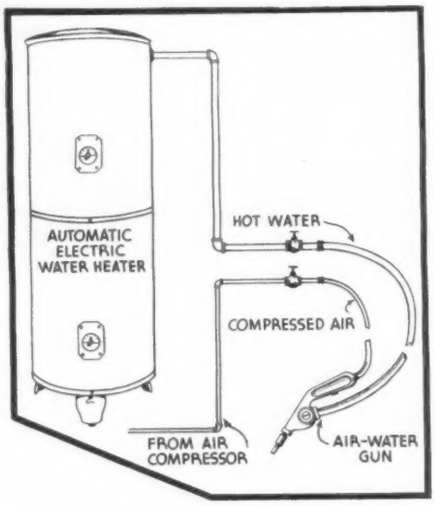
UNUSUAL COMMERCIAL LOAD FOR WATER HEATERS



Within a few weeks after the introduction of a new "steam" cleaning method to facilitate the cleaning of automobile motors, etc., the Washington Water Power Company sold 25 electric water heaters to garages, service stations and machine shops. Developed and first installed by the Olive Service Station, Kamiah, Idaho, and quickly taken up by the power company for its load potentialities, the method involves the use of hot water supplied by an automatic electric water heater, compressed air and water gun. Experience has shown that a motor can be washed by this method in ten minutes for about 11 cents. The device speeds up the job of thawing engines and by eliminating the task of working with dirty or greasy parts saves time in repair work.

10-Kw. Space Heater for Softening Problem

When H. W. Kaupisch of Nuspred Foods Company, Portland, Ore., first began manufacturing his new hydrogenated vegetable shortening for use in seasoning, baking and frying he was confronted with the problem of softening the vegetable fats to the correct temperature, between 95 and 100 deg. Below 95 deg. the fats were likely to be hard on the inside, soft on the outside. Above 105 deg. the fats turned to oils. Uniform consistency was almost impossible to attain.

The answer to the problem was the installation of a thermostatically controlled 10 kw. electric space heater in a softening room measuring 13x17x7 ft. Now, as a result, he can soften from 6,000 to 10,000 lb. at one time.

Electric space heater recently installed by Nuspred Foods Company

Although the softening period is 20 hours, no attention need be paid to the heater. Other advantages of the system are low cost of operation and cleanliness, which obviates the necessity for covering the cans.

ACCEPT THIS *free* TRIAL OFFER:

Here's your opportunity to prove for yourself—on your own measuring work—the outstanding advantages of the New Ferranti Clip-On Ammeter. So here's our offer: we'll send one of these convenient, useful DUAL RANGE instruments for 2-WEEKS FREE TRIAL if you will tell us the range of measurements you wish to make. (You'll find the standard ranges available listed below.)

New **FERRANTI** *Clip-on* **AMMETER**

You'll like the single-handed operation which leaves the other hand free. Then, too, you'll find the dual range feature remarkably convenient—just turn the switch and the range of measurement is instantly changed. And you'll appreciate its safety in measuring current in A.C. conductors and bus bars.

TRY the Ferranti Clip-On Ammeter—on bus bars or insulated conductors—determine balance on 3-wire systems or 3-phase circuits — on feeders, motors, switches, transformers, etc.

Use coupon below. Specify the range by TYPE or capacity.

RANGES

TYPE	A 0-100/500	Amperes
"	B 0-100/1000	"
"	C 0-200/1000	"
"	X 0-300/1500	"
"	H 0-7½/75	"
"	D 0- 10/50	"
"	E 0- 15/75	"
"	F 0- 20/100	"
"	I 0- 25/150	"
"	G 0- 50/250	"

Mail this coupon today →

FERRANTI ELECTRIC, Inc.
30 Rockefeller Plaza, New York, N. Y.

Please ship without obligation, a Ferranti Clip-On Ammeter for 2-weeks FREE Trial. Type ..... Range .....

Name .....

Company .....

Address .....

News ABOUT PEOPLE

Shawinigan Appoints New Assistant General Managers

Shawinigan Water & Power Company has announced the appointment of four assistant general managers: R. J. Beaumont, J. B. Challies, P. S. Gregory and John Morse.

Mr. Beaumont joined Shawinigan in 1910. From the ranks of the technical staff he has gradually and successfully assumed increased responsibilities in the positions of chief draughtsman, purchasing agent and manager in charge of the commercial and distribution department.

After a distinguished career in the federal government engineering services, which culminated in his appointment in 1920 as director of water power for Canada, Mr. Challies joined Shawinigan as departmental manager in charge of water conservation and official negotiations.

A graduate of Bishop's University in 1908 and McGill in 1911, Mr. Gregory obtained extensive experience in electrical engineering work with Westinghouse, Montreal Tramways and the Montreal Electrical Commission. Since 1918 he has been closely associated with the president of Shawinigan in furthering the sale of power to large consumers and in strengthening the company's technical position in relation to the other large distribution systems of the province.

Mr. Morse had a noteworthy engineering career in Sweden before joining the company in 1907. In recent years he has been general superintendent in charge of generation and transmission.

•

▶ COL. W. R. MCCAFFREY has been appointed secretary of the Canadian Engineering Standards Association, succeeding B. Stuart McKenzie. Mr. McKenzie, who has been secretary of the Canadian Engineering Standards Association for eleven years, is retiring because of ill health, but will continue to serve the association in the position of consultant.

▶ CHARLES E. GREENE, for the past ten years electrical and mechanical engineer for Metcalf & Eddy, Boston, consulting engineers, has been appointed to a similar position with the consulting organization of Cleverdon, Varney & Pike, with offices in Boston.

▶ J. A. PROCTOR has been appointed assistant manager of the General Electric air conditioning department. Mr. Proctor, who for the past three years has been assistant to C. E. Wilson, G.E. vice-president, will henceforth make his headquarters at Bloomfield, N. J.

▶ HARVEY C. COUCH, president of the Arkansas Power & Light Company, has been elected by member banks in group No. 2 as a class B director of the St. Louis Federal Reserve Bank.

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Mississippi Power Elects Two New Vice-Presidents

H. B. Sargent

W. A. Moore

At a recent meeting of the board of directors of Mississippi Power & Light Company Henry B. Sargent was elected vice-president in charge of operations and W. A. Moore vice-president in charge of sales. Mr. Sargent became a member of the Mississippi Power & Light organization in 1927. For several years he was office assistant to the vice-president and general manager of the company, becoming assistant to the president in 1932. In 1936 he was elected secretary of the company after having served as assistant secretary for four years.

Mr. Moore has been in charge of the company's commercial, industrial, governmental and municipal sales for several years. In addition he has been active in industrial development work in Mississippi and will continue to supervise the activities of this department of the company.

•

▶ R. R. WHIPPLE, assistant professor of electrical engineering at the University of Iowa, has been appointed designing illuminating engineer with The Trippe Manufacturing Company,

YUH KNO', FRED, IT WAS CHILD'S PLAY TO BRING THIS CONDUIT JOB UNDER THE WIRE.... ...GUESS THEY DIDN'T ESTIMATE ON OUR LAYING ORANGEBURG ... ... WE BEAT ALL THE FIGURES, MAN HOURS, MATERIALS, TRUCK TIME, AND.....
YOU SAID IT!
PLAY STREET
ORANGEBURG
THE FIBRE CONDUIT COMPANY
ORANGEBURG - N.Y.
SALES AGENTS
GRAYBAR ELECTRIC CO.
GENERAL ELECTRIC SUPPLY CORP.

STRAIGHT and TRUE to REQUIRED DEPTH

Speeds up the work by several hundred percent

Highway
EARTH BORING AND POLE SETTING MACHINES

DIG through frozen ground and save money while the job is in progress. Lighten the amount of manual labor and add a high degree of safety. Bore at difficult angles and hard to reach places. This all adds up to the advantage of Central Stations for cold weather maintenance or line construction work. There are many types and sizes available—mounted on truck or tractor. Write for descriptive literature.

HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

Chicago. Mr. Whipple has been a member of the faculty of the electrical engineering department at the University of Iowa since 1928. He has written several papers on illuminating engineering subjects and is a member of the Illuminating Engineering Society.

•

Henry L. Doherty Named Lucas Medalist by Engineers

Henry L. Doherty, president and founder of Cities Service Company, has been awarded the Anthony F. Lucas Gold Medal by the American Institute of Mining and Metallurgical Engineers for distinguished achievements. Although an inventor, economist, financier and a leader in three important branches of American business—electric power, gas and petroleum—Mr. Doherty prefers to be known as an engineer.

For many years Mr. Doherty was one of the guiding spirits of the Society for Electrical Development and during his occupancy of the presidency of the National Electric Light Association (1901) he broadened its program to include commercial and accounting activities as well as engineering functions.

•

► LEROY RICHARDSON, for eight years superintendent of the municipal power and light plant at Murray, Utah, has resigned.

► D. P. PARDEE, formerly connected with the Stone & Webster Service Corporation, has been elected comptroller of the Public Service Company of Indiana to succeed L. B. Schiesz, who resigned to become vice-president and general manager of the Northern Indiana Power Company. For the past

JUST RIGHT!

NOT TOO FAST

To permit the breaker on the secondary to function.

NOT TOO SLOW

To prevent line outage due to primary fault. Clears 20,000 ampere short in ½ cycle.

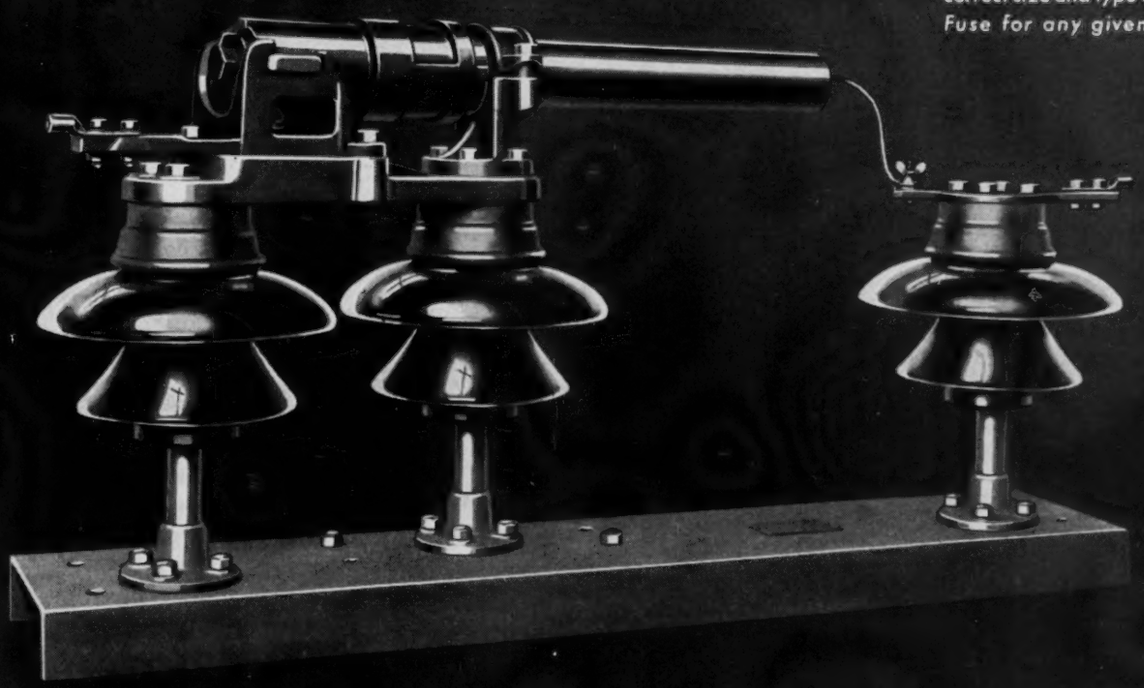
ABSOLUTELY RELIABLE

HI-VOLTAGE Fuses have proved their reliability in both extensive tests and wide service. The burning of the fuse link creates a high pressure within the tube, thereby expelling the gases and any unconsumed portion of the link, at a high velocity. *The arc is cleared within the fuse tube;* the air gap serving chiefly to prevent any leakage of current through or over the fuse tube after the fuse has blown. The tubes are so proportioned that high pressure and velocity are developed on light loads, thereby *clearing any load that will melt the fuse wire.*

HI-VOLTAGE FUSES

Establish an air gap in the line simultaneous with the blowing of the link.

BULLETIN NO. 24 gives all of the information required to select the correct size and type of HI-VOLTAGE Fuse for any given requirement.



HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH ST., CLEVELAND, OHIO

INSULATION FAILURE TIES UP PLANT 24 HOURS

Due to weakened insulation, an important feeder cable "let go" recently in a large mill in New Jersey. Result—complete shut-down of the plant for 24 hours, and the Electrical Engineer *"on the spot."*

Don't Let This Happen To You!

It happened, however, that for six months the Electrical Engineer had been trying to convince the management that a "Megger" insulation testing instrument would detect weaknesses in their incipient stages and forestall just this kind of trouble—would save money for the plant and incidentally *protect him.* But because they had been "getting along" without it, his recommendation for a "Megger" was refused and the "inevitable" happened—a 24-hour shut-down of the *entire* plant at a time when they were running three shifts.

Needless to say . . . He got his "Megger"!

A recent model of our "Meg" Insulation Tester with a 500-volt hand generator and ohmmeter for measuring conductor resistance in ohms and insulation resistance up to 100 megohms.

Trouble like this is being forestalled every day in plants where maintenance departments make periodic insulation resistance tests with "Megger" instruments.

Write today for descriptive Bulletin 1355-W which will help you to select the type and rating of "Megger" instrument best suited for the electrical equipment in your plant.

JAMES G. BIDDLE CO.
1211-13 Arch Street, Philadelphia, Pa.

"MEGGER" INSTRUMENTS

five years Mr. Pardee has been providing financial and accounting service to operating utilities.

▶ ROY SCUDDER has been appointed superintendent of the Nevada-California Electric Corporation at Blythe, Calif. He has been acting superintendent since the death of the late D. F. Cavanaugh.

▶ CLARENCE WITTMER has been appointed national service manager of the Emerson Electric Manufacturing Company, St. Louis, Mo., to succeed W. A. Devlin, resigned.

▶ CLAUDE J. HENDON, manager of the heating device sales section of the General Electric appliance and merchandise department, Bridgeport, has been appointed chairman of the domestic appliance section of the National Electrical Manufacturers Association. Mr. Hendon became manager of G.E. heating devices in 1934 and has been closely identified with appliance merchandising for the past sixteen years.

▶ JOHN T. WHITTEN, lineman of the western division of the Alabama Power Company, was awarded the president's medal of the National Safety Council for successfully resuscitating a woman after her apparent drowning in the canal at Lock 17. Before an audience composed of company executives, department heads and western division employees, Thomas W. Martin, president of the company, made the award. This is the second medal of its kind to be awarded an employee of this company, the first being awarded to Lawrence I. Hazel of Mobile last summer.

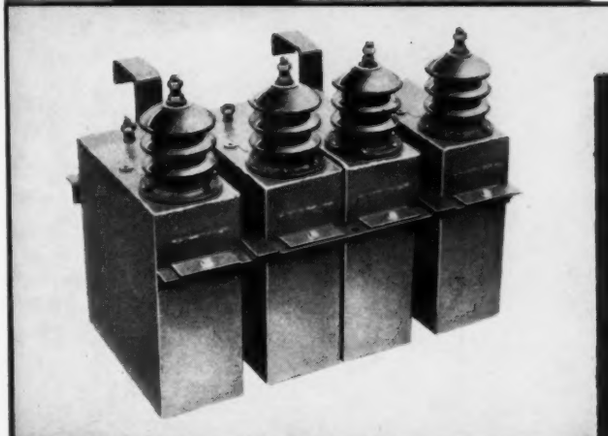
▶ H. SIDNEY SMITH, consulting engineer of the Union Carbide Company, New York, has been made the recipient of the Samuel Wylie Miller Memorial Medal for "meritorious achievement contributing conspicuously to the advancement of the art of welding and cutting." For a great many years, and until the time of Mr. Miller's death, Mr. Smith and Mr. Miller were closely associated in their technical, business and engineering society activities. For many years Mr. Smith has been a director and a member of the executive committee of the American Welding Society. He is also a member of the American Society of Mechanical Engineers, American Society for Testing Materials, National Fire Protection Association, National

Helping the Utilities Carry Increased Loads

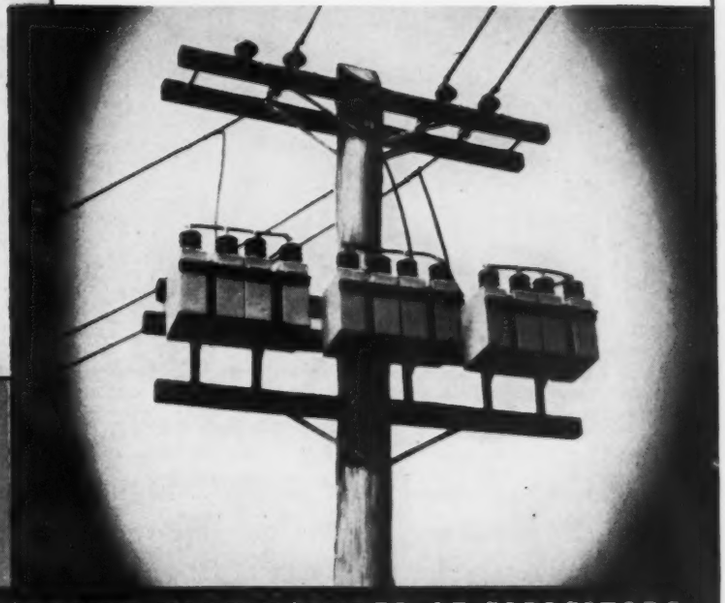
CORNELL-DUBILIER Capacitors FOR IMPROVEMENT OF LOW POWER-FACTOR ON DISTRIBUTION SYSTEMS

INCREASING pay loads during the past year have forced many utilities to investigate the capacity of their present distribution systems. One of the increasing major "leaks" in distribution system efficiency is poor power-factor. C-D Pole-Type capacitors, designed to improve this condition, enable utilities to obtain more KW capacity at ONE-SIXTH THE COST OF OTHER METHODS OF INCREASING SYSTEM CAPACITY. In addition, capacitors are quickly and economically installed, are easily shifted to meet changing load conditions . . . will increase line voltage, improve voltage regulation, and relieve all apparatus back to the generator of unnecessary rkva.

TODAY! Investigate this low cost method of increasing feeder capacity. Savings alone will pay for the cost of capacitor installation within twelve to eighteen months. C-D field engineering offices throughout the United States will gladly cooperate with you in planning your requirements. Send for Catalog No. 143 today. *Use convenient coupon below.*



2,300, 4,000 and 4,600 volt, one or two bushing 15 kva pole-mounting units on multiple cross arm bracket. Hermetically sealed in weather-proof containers. No further housing required. Inexpensive to install, no maintenance after installation and proven dependability, make the C-D capacitor the ideal power-factor unit.



WORLD'S LARGEST AND OLDEST EXCLUSIVE MANUFACTURER OF CAPACITORS

CORNELL-DUBILIER Electric CORPORATION

South Plainfield, N. J.

CORNELL-DUBILIER ELECTRIC CORPORATION EW 12-4
SOUTH PLAINFIELD, N. J.

Please have your representative call ☐ *send catalog* ☐

Name.....

Address.....

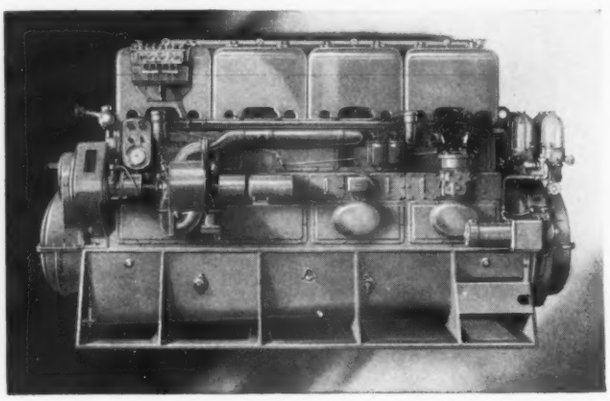
City..... *State*.....

Where Natural Gas Is Available

POWER CAN BE DEVELOPED ON LOW PRICED FUEL UNDER 3 MILLS PER K. W. H. FUEL COST

STERLING HIGH DUTY INTERNAL COMBUSTION ENGINES

GAS—GASOLINE—OIL ENGINES



8-Cylinder Sterling Gas Engine, Bore 8", Stroke 9", dual overhead valves, removable cylinder sleeves, counterweighted crankshaft.

Scientifically built 900 R.P.M. engines, utilizing modern metallurgy, have been proven in service. Repeat orders for 21—400 H.P. engines from one client in 1937! Outstanding mechanical developments at a low price, warrant your investigation.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, New York

Dept. C-2

Branch Office
900 Chrysler Bldg.
New York, N. Y.

Safety Council, American Society of Safety Engineers and a number of engineering groups.

▶ OSCAR CLEAVER of Westinghouse Lamp Company, designer of lighting displays at the Chicago World's Fair, is now engaged in similar work for the 1939 New York World's Fair.

▶ C. H. JOHNSON, who has been electrical engineer for the Idaho Maryland Mines Corporation, Grass Valley, Calif., has been appointed electrical engineer with the General Electric Company, San Francisco.

▶ H. S. SCHULER has been appointed division manager of industry advertising of the Westinghouse Electric & Manufacturing Company.

▶ H. S. TURNER has been appointed manager of the order and distribution department, Kelvinator Division, Nash-Kelvinator Corporation, to succeed H. K. Lyons, resigned.

▶ WILLIAM H. STANGLE has been appointed to direct the home air conditioning activities of the Westinghouse Electric & Manufacturing Company. Mr. Stangle has long been identified with various air conditioning merchandising and building activities. He will maintain offices in Mansfield at Westinghouse merchandising headquarters.

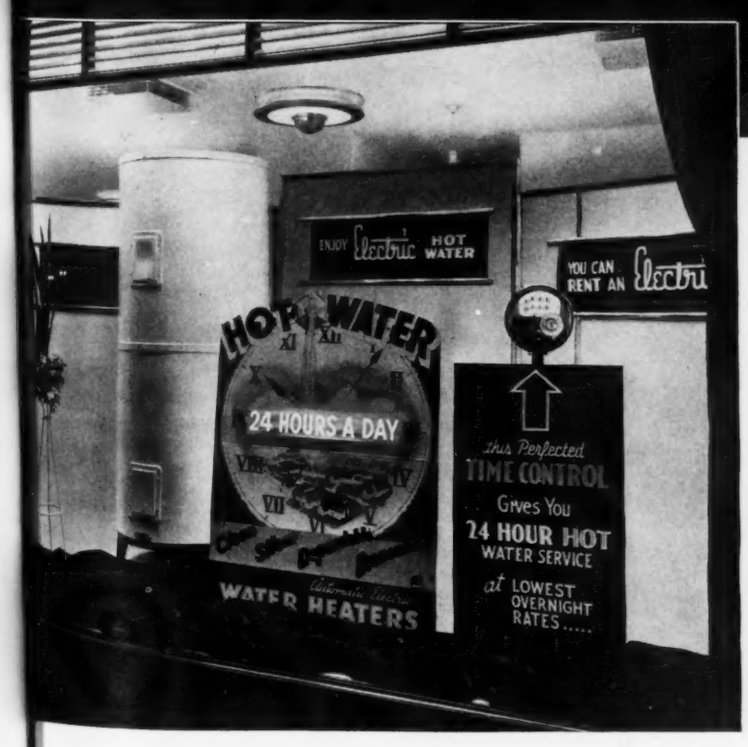
▶ W. F. WATT, JR., recently made sales promotion manager of the Westinghouse Electric Supply Company at Richmond, Va., has just moved to that city from Mansfield, Ohio, where he was in the refrigeration sales department.

OBITUARY

▶ PROF. JAMES A. CORRELL, electrical engineering department, University of Texas, died October 30. Professor Correll had been continuously associated with the University of Texas since 1907, becoming head of the electrical engineering department in 1927. He was elected to the graduate faculty in 1930. He was active in the American Institute of Electrical Engineers, for many years being counselor to the student branch at the University of Texas. In 1936-37 he served as president of the Texas section of the Society for the Promotion of Engineering Education. In collaboration with J. M. Bryant, he wrote "Alternating-Current Circuits," published by McGraw-Hill. He was 54 years of age.

The meters of today

FOR THE LOADS OF TO-MORROW



meter illustrated above in the view of the center window can be plied in either "A" or "S" mountings; with single or two rate registers.

Plan *Now* for *Future* Load Building

The success of modern window displays in promoting load building campaigns is usually dependent on attractive rates.

Attractive "step-rates" have long been effective in load building. More recently, "off-peak rates" have gained in favor. But now—thanks to a far-sighted plan and the use of time-controlled two-rate meters—the additional application of "step-rates" on the low rate dial has proven successful in the advancement of off-peak loads.

Thus, the meters of today are designed to fit into your load building plans of to-morrow.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Manufacturing AND MARKETS

Manufacturers Vote Dividend Payments

Westinghouse Electric & Manufacturing Company has declared a dividend of $2 per share on the preferred and common stocks of the company, payable December 21 to stockholders of record at the close of business on December 7. This brings the total paid per share in 1937 to $6, as compared with $5.50 in 1936.

Other electrical manufacturing companies have announced dividends as follows:

Wagner Electric Company has declared a dividend of $1.25 a share on the common stock, increasing the amount from 50 cents paid on March 20, June 21 and September 20 this year.

James R. Kearney Corporation declared a dividend on the recently split common stock of $1.25 a share, payable 25 cents in cash and $1 in the form of the new $25 par value 6 per cent preferred stock. Both are payable December 10 to stockholders of record December 1. There will be no fractional shares issued, as the company will disburse cash in lieu thereof.

Acme Wire has declared an extra dividend of $1 on common. A dividend of $1 was paid on November 15.

Aluminum Company of America has declared the $1.50 quarterly dividend on the 6 per cent preferred stock plus a dividend of $2.25 a share against arrears on the issue. On October 1 similar payments were disbursed.

Blaw-Knox Company, 50 cents, making a total distribution this year of $1.20 a share. This represents an increase of 40 cents a share over the amount paid in 1936.

Cutler-Hammer, Inc., 25 cents on the new common stock, following a two-for-one stock split-up. Payments on the old stock were 50 cents each on March 15 and June 15 and $1 on September 15.

Electric Storage Battery Company has declared a final dividend for 1937 on the common and preferred stocks of the company of $1 per share, payable December 21 to stockholders of record December 1.

•

Machinery Exports Show Nine-Months' Gain of 25%

Exports of electrical machinery and apparatus in September mounted to $8,995,000, compared with $8,981,000 in August and $7,970,000 in September last year. For the first nine months exports totaled $83,350,000, as against $66,684,000 for the corresponding period last year, according to the Department of Commerce.

Exports of household refrigerators in September numbered 8,838, valued at $726,000, compared with 12,429, value $960,000, for August and 12,773, valued at $999,000, for September, 1936. For the first nine months exports were 138,909, value $10,349,000, against 130,912, value $9,572,000, for the corresponding period last year.

•

Large Increase in Appliance Sales

Sales of various types of enameled electrical appliances are running far ahead of last year's figures and those for the first eight months of 1937 exceed the totals for the entire preceding year, according to statistics presented by George S. Blome at the second Porcelain Enamel Institute Forum at Ohio State University recently.

Among the sales of porcelain enameled goods listed by Mr. Blome the following are of particular interest to the electrical industry:

Item	Year 1936	8 Mos. 1937
Household electric refrigerators (units)	1,595,806	1,877,975
Commercial electric refrigerators (value)	$11,856,000	$15,200,000
Washing machines (units)	1,204,227	1,245,520
Ironers (units)	125,548	128,589
Electric ranges (units)	202,987	284,043
Gas ranges (value)	$67,110,000	*$38,450,000

*Six months of 1937 only figures now available.

It will be seen that in eight months of 1937 sales of household refrigerators exceeded those in the entire year 1936 by 17.5 per cent, while range sales increased by 40 per cent.

Gain Shown in Orders for Electrical Goods

Value of orders for electrical goods booked during the first three-quarters this year exceeded the corresponding figure for 1936 by 39.5 per cent, according to the Department of Commerce. By quarters, the rate of increase over 1936 was successively 76.5, 37 and 12.8 per cent.

Comparative data are as follows:

	1937	1936
First quarter	$271,064,295	$153,452,432
Second quarter	260,835,867	190,597,939
Third quarter	215,963,847	191,318,710
Fourth quarter	.....	228,061,814
Total	.....	$763,430,895

While neither the high dollar volume of the first quarter nor the percent gain over last year was maintained in subsequent periods, it is seen that even the third quarter shows a comfortable margin over 1936. Moreover, comparison with other years indicates that the total for 1937 will exceed that for any previous year except the $1,065,510,043 of 1929. The next highest was 1928, about $823,000,000.

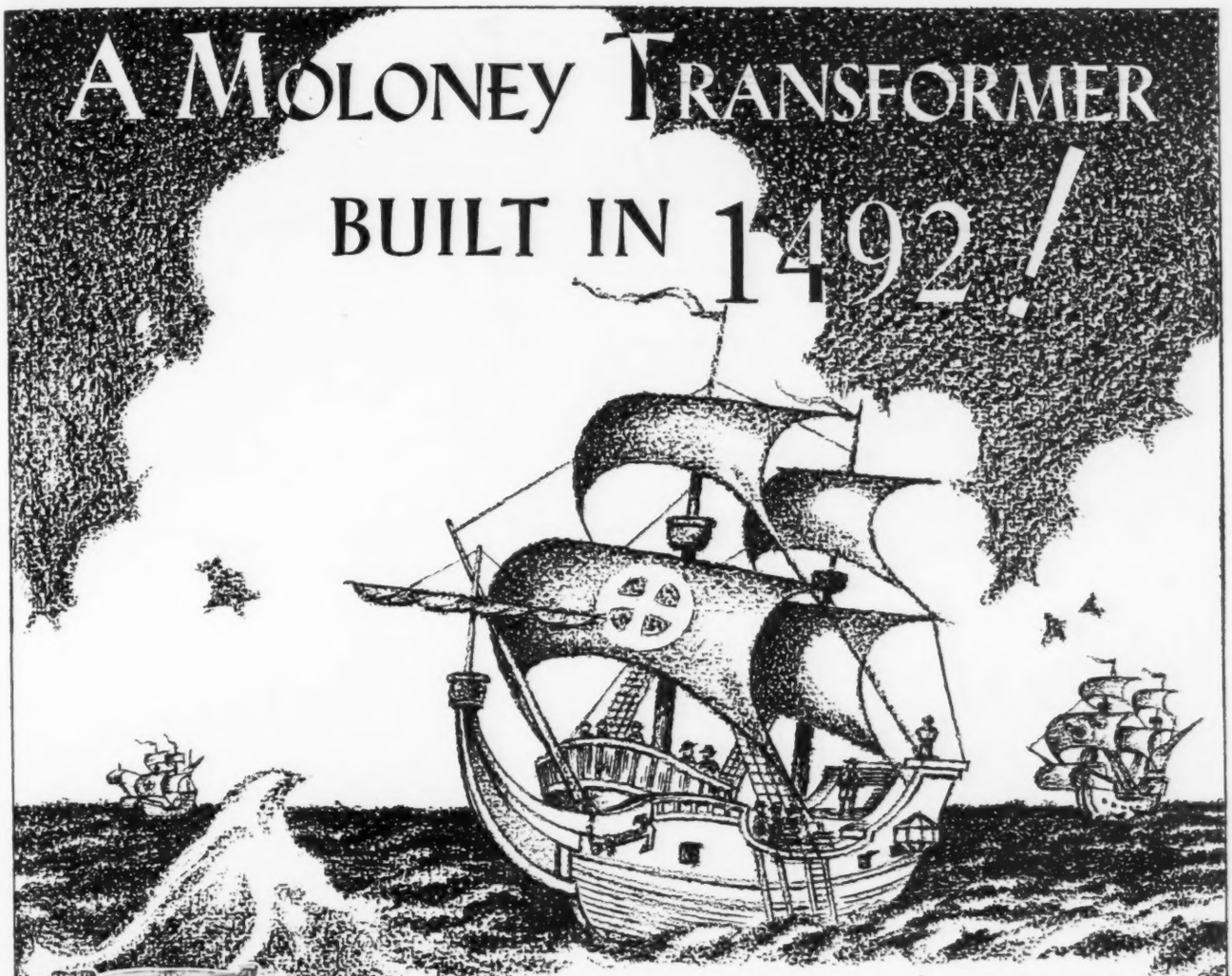
The figures here given are based on reports by 78 manufacturers and therefore are not a complete statement for the industry, but are regarded as sufficiently representative to indicate these trends.

•

Carrier's Self-Contained Commercial Refrigeration

Last July the Carrier Corporation presented a self-contained line of refrigeration and display cases for meat and delicatessen stores. Now it introduces a 35-cu.ft. "reach-in" electric refrigerator for commercial use and announces that shortly after the first of the year it proposes to market such additional new products as a bottle beverage cooler in two sizes, a unit

A MOLONEY TRANSFORMER BUILT IN 1492!



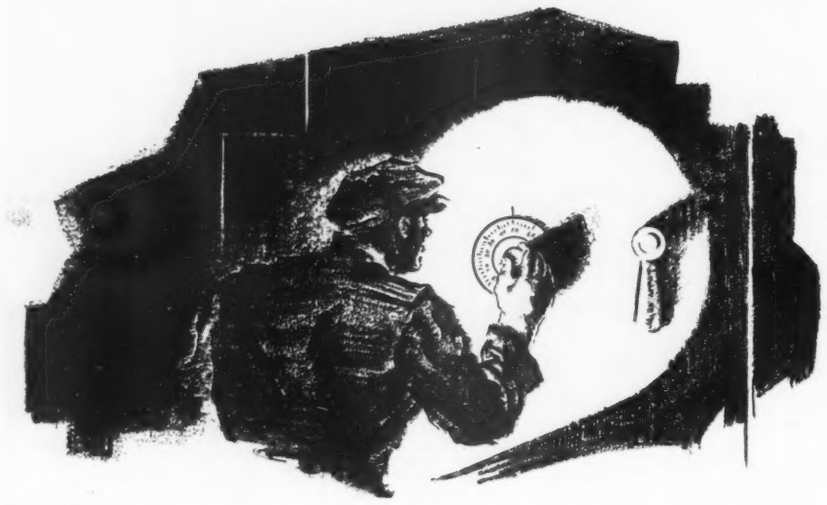
Of course we'll agree . . . in Columbus' time transformers were undreamed of. But, according to the figures of one of our customers, a Moloney Transformer placed in service at that time, would still be providing satisfactory service today!

With over 18,000 Moloney units in operation, burnouts from all causes have cost this customer but two tenths of one per cent annually since 1908. On this basis the average life of these transformers would be 500 years!

Naturally, we do not claim any such life for our transformers. We merely wish to call your attention to the fine economy that is yours when you buy Moloney Transformers.

MOLONEY TRANSFORMERS

INSULATION HEADQUARTERS



It's an
UNUSUAL COMBINATION

Continental-Diamond products possess such unusual combinations of insulating and mechanical properties that new uses for them are being announced almost daily. Some are discovered by our customers, but the majority come to light in Continental-Diamond's laboratory where service engineers are constantly working on problems presented by manufacturers who want to boost performance or reduce costs. With so wide a variety of insulating materials to work with and so much practical experience behind them, it's no wonder our engineers are adept at finding the "combination" that opens the door to improvement. Have you a problem for them to tackle? Write today.

CONTINENTAL-DIAMOND FIBRE CO.

Newark, Delaware

Represented in Canada by DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO

DILECTO

A laminated plastic, commonly known as phenol fibre, made in sheets, rods and tubes or fabricated parts to specifications. Has high electrical insulation properties, great resistance to water, practically unaffected by oil or mild acids. It is a strong, tough material with a wide application for use in connection with modern electrical appliances.

DIAMOND VULCANIZED FIBRE

A tough, economical, insulating material made in standard sheets, rods and tubes. Can be readily fabricated or formed. A material of countless applications.

VULCOID

A thermo-plastic, non-hygroscopic insulating material made in standard sheets, rods and tubes. It is strong and tough, has good electrical insulating properties and is readily fabricated.

MICABOND

Thin splittings of mica bonded together with specially developed binders into standard plates, tubing or in formed rings, punched and sawed segments or other special parts. Micabond has high dielectric strength, is practically unaffected by acids, has high heat and moisture resistance, is readily punched, sawed or formed.

CELLULAK

A laminated form of insulating tubing, possessing extremely high dielectric properties, and marked resistance to flash-over.

DILOPHANE

A translucent, laminated plastic in colors. It provides perfect light diffusion, is not inflammable, and is manufactured in practically any color imaginable with either a glossy or dull finish.

water cooler in three types and a self-contained ice cream freezer.

According to L. R. Boulware, vice-president and general manager, this move is prompted by the thought that the more self-contained commercial refrigeration can be made the simpler will be the selling job and the greater will be the national coverage through dealer outlets.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have made the following assignments to their sales staffs:

L. H. Miller, who for the past year has been manager of the Allentown, Pa., branch of the General Electric Supply Corporation, has been named sales manager of the domestic refrigeration sales section of the General Electric Company with headquarters in Cleveland. O. D. Miller, district manager of appliance sales for General Electric Suppy at Dallas, has been appointed manager of the Allentown branch succeeding L. H. Miller. Charles R. Pritchard, formerly appliance sales manager for General Electric Supply at Atlanta, Ga., has been appointed manager of specialty appliance sales for the same organization at Bridgeport, Conn.

McGill Manufacturing Company has increased the territory covered by its Detroit representatives, Turrell & Benfield, Inc., to include the cities of Cleveland, Akron, Canton and Youngstown, Ohio.

•

Secures Transformer Award

The Lower Colorado River Authority, Austin, Tex., has awarded a contract to the General Electric Company for four transformers and accessories for installation at power project near Marshall Ford, Tex., at a price of $112,450, each with rated capacity of 6,667-kva., 138,000/69,000/13,800-volt, Y-type units.

•

Lightning Arrester Award

Westinghouse Electric & Manufacturing Company has been awarded a contract by TVA, Knoxville, Tenn., for lightning arresters for electric power and distribution lines in vicinity of Corinth, Miss., at a price of $18,000.

New York Metal Prices

	Nov. 23, 1937 Cents per Pound	Nov. 30, 1937 Cents per Pound
Copper electrolytic	11.00*	10.75*
Lead Am. S. & R. price	5.00	5.00
Antimony	15.50	14.75
Nickel ingot	35.00	35.00
Zinc spot	5.85	5.60
Tin Straits	41.00	42.50
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.

TODAY'S trend is toward long term economical buying. AmCreCo poles are perfect examples of such economy for they offer long life with low upkeep cost. They have AmCreCo's experience of thirty years in producing creosoted products, behind them. Successful electrification projects depend on trouble free equipment. That means the erection of good poles needing minimum maintenance. AmCreCo poles fit the requirements perfectly.

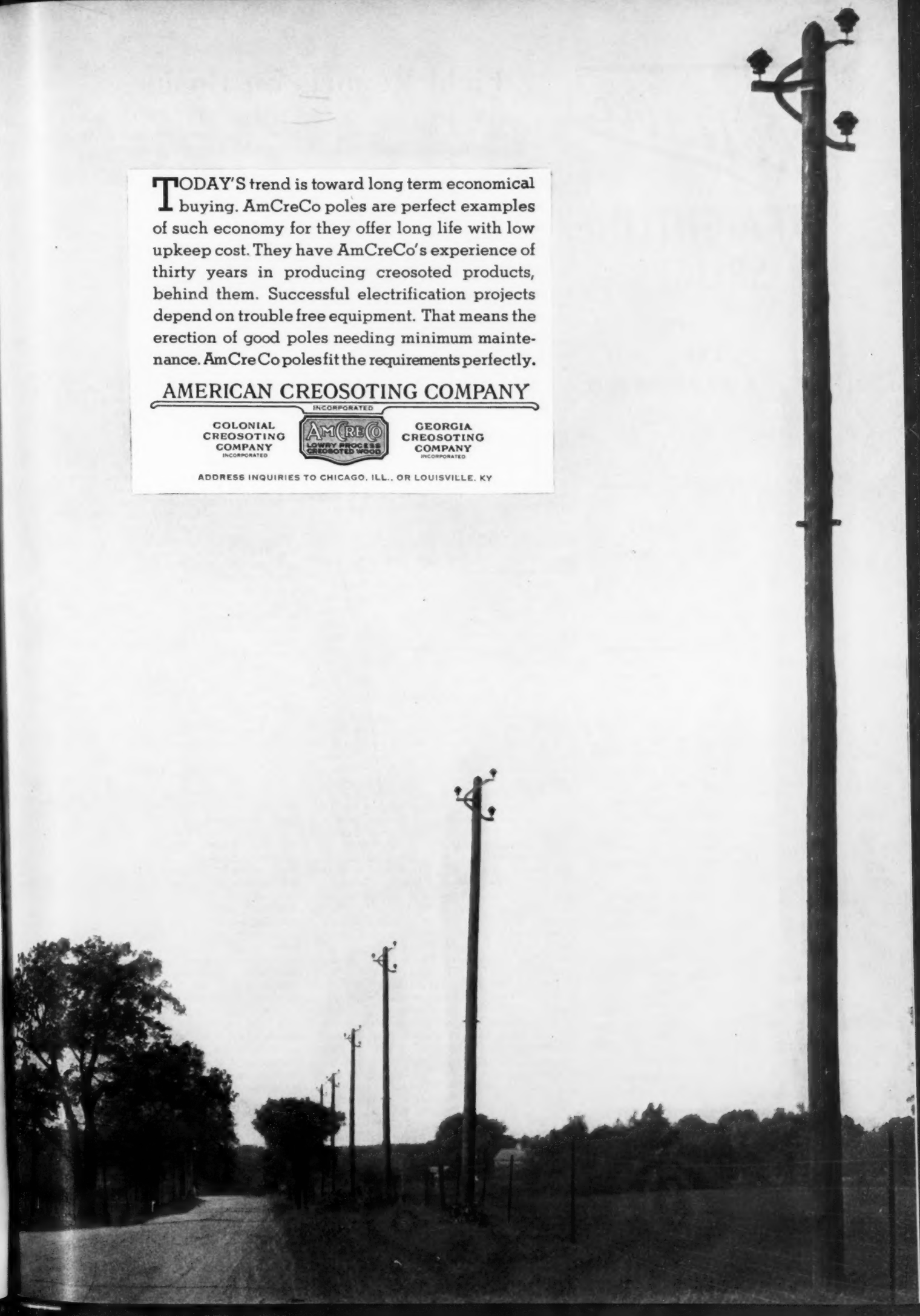
AMERICAN CREOSOTING COMPANY
INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCREO LOWRY PROCESS CREOSOTED WOOD

GEORGIA CREOSOTING COMPANY INCORPORATED

ADDRESS INQUIRIES TO CHICAGO, ILL., OR LOUISVILLE, KY



Reliable

STRAIGHTLINE SPLICES

FOR

TYPE "A" COPPERWELD WIRE

•

Specially

designed and built to consistently hold approximately the full strength of type "A" conductors.

The Reliable Straightline Splices for Copperweld composite cable are equipped with jaws which grip the wire over a long enough surface to insure consistent holding of this three strand wire with its long lay. These splices retain the outstanding features pioneered in the standard Straightline Splices.

The gripping power of this splice is so great that under test it breaks the wire at approximately its full strength. It makes a good electrical joint, and it is positive in operation.

Send for Bulletin and Samples

★

Reliable ELECTRIC COMPANY

OVER 25 YEARS SERVICE TO THE UTILITIES

3145 CARROLL AVENUE • CHICAGO ILLINOIS

Field Reports on Business

Having been buffeted around by vitriolic attacks and punitive measures by the New Deal, business is skeptical of the overtures made at co-operation to combat the present recession. Production and sales are at or near bottom in many lines. Hopes are expressed that Christmas buying will brighten the situation.

NEW YORK

Industry is still confused as to how far President Roosevelt will go in erasing punitive measures which have tended to undermine business and have brought on the present recession. Good moves on the one hand have been nullified by attacks on the other. Business leaders are hoping that a good Christmas season trade will do much to lift production schedules to higher levels.

Reports indicate that there is no rush for deliveries. Production schedules have been curtailed in many lines. Backlog of orders are fast dwindling, with little new buying evident. The bright hope in the situation is the prospect that should the government housing program attract public fancy good trade is the prospect for early spring.

Construction budget figures of utilities for 1938 indicate that a great deal of work will be done despite the present gloomy state of business. Some companies are expanding building plans, providing for additional generating capacity, while others are maintaining expenditures near the 1937 level.

The decline in prices of basic materials is expected to answer some of the problems which have held up forward buying and construction. The emphasis which President Roosevelt has placed on this may produce the desired correction and start a revival in the heavy industries.

NEW ENGLAND

Central Maine Power is completing construction of 260 miles of rural service lines built this year. Another utility construction job just finished is a service station building for the New England Power Company transmission system at Tewksbury, Mass. Boston Edison has awarded a contract to the Babcock & Wilcox Company for increasing the capacity of four boilers at Edgar station, raising their steam pressure to 1,400 lb. per sq.in.

During the past week electrical equipment sales in this district showed a moderate upward trend. Industrial sales were steady; one manufacturer reported steady buying in small lots of small motors; appliance manufacturers are active and are purchasing fractional-horsepower motors in good volume. Machine manufacturers, on the other hand, are less evident in the market.

Interior lighting is progressing. A Connecticut department store is planning to enlarge its building with extra high intensity lighting, scheduled for operation in the fall of 1938. In the Boston area lighting for institutions is quite active; new projects involving $750,000 have been prepared for the school department of Cambridge. A new fire station which will include extensive wiring and electrical signaling apparatus is being designed for Quincy, Mass., and will cost about $135,000.

It is expected that the trustees of Boston University will act favorably on the proposal to construct the first of several units to be located on a new site and estimated to cost about $1,000,000.

Merchandise sales in Boston are gaining and according to one prominent distributor already presage an active holiday trend. Electrical laundering apparatus buying is showing marked advances; in Vermont refrigerator sales to date this year have reached a total of 3,281 units, or 126.2 per cent above the quota.

CHICAGO

General business continued its adverse trend during the past week. Industrial activity appears to have a resting place for the moment, suggesting the possibility that an upward movement may not be too far off. One discouraging feature, however, is the continued drop in employment. Even the merchandising field has failed to increase its personnel to any great extent as is usual for this season. Special sales and prospective price reductions in many lines are expected to stimulate buying before the end of the year is reached.

Electrical contractors' activity is at the low point for the year. Manufacturers report further reductions in orders and inquiries received. Telephone installations continued to gain over last year, showing an increase of 5 per cent. New rate reductions are expected to stimulate even greater telephone use. Electrical energy output showed a moderate increase over the previous week.

Utility purchases have declined considerably as numerous construction projects are being temporarily postponed. Forty-three per cent of the manufacturers reporting to the electric association show a decrease in sales from the previous month, while 21 per cent remained unchanged.

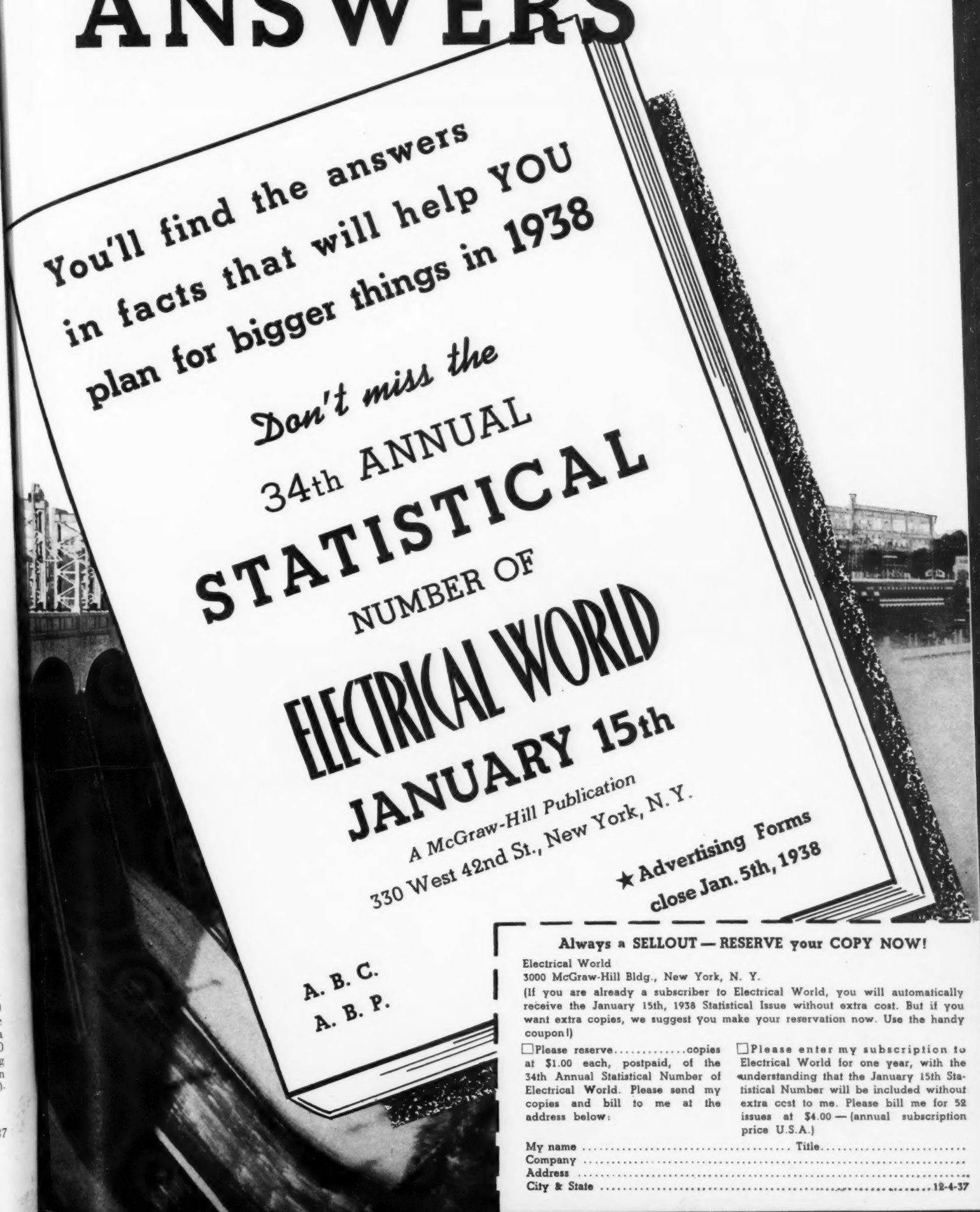
PACIFIC COAST

The surprisingly large public response to the first holiday shopping days scheduled by coast department stores has encouraged the trade to expect a good season and has produced a more hopeful attitude toward business in general. Concerted efforts are being made by business groups to stabilize the labor situation and a better temper is observable in mutual handling of recurring minor points of disputes by both sides.

Industrial business undoubtedly reflects the general uneasiness over certain Administration policies because, despite large planned construction, actual buying is very slack and manufacturers who specialize in such materials as reflectors, motors, controls and heavy load wiring devices report a disappointing sag after the spring build-up.

In the radio broadcasting field both governmental and commercial agencies are particularly active, including such announcements as a $1,000,000 high-frequency transmitting and master receiving station at Mare Island Navy yard, combining the duties of several scattered stations; a $350,000 installation and enlargement by the Palace Hotel for Columbia Broadcasting, and a $1,000,000 unit of a proposed $4,000,000 investment by the National Broadcasting Company in a 400-ft. square building in Los Angeles to include several 3,000-spectator-capacity auditoriums.

ANSWERS



You'll find the answers in facts that will help YOU plan for bigger things in 1938

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34th ANNUAL

STATISTICAL

NUMBER OF

ELECTRICAL WORLD

JANUARY 15th

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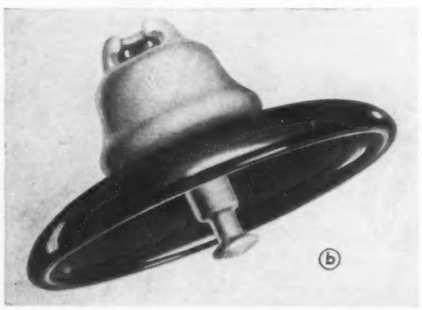
New EQUIPMENT AVAILABLE

Suspension Insulators

Two new rugged suspension insulators, one of petticoat design and one with a smooth disk, are designed with high impact resistance to minimize breakage from

Rugged suspension insulators; either 5 or 5¾-in. spacing; socket cap and ball pin on 5-in. types, socket cap and ball pin or clevis cap and pin on other. **Ohio Brass Co.,** Mansfield.



various forms of missiles and from possible rough handling during shipment and installation. Petticoat type (a) is intended for use on lines subject to rock throwing and demanding standard flashover values and full leakage distance. Other type (b), designed to deflect missiles from smooth under surface without damaging insulator, is for use on lines subject to gun fire. Both types have a 10-in. disk and 15,000 lb. M. & E. rating.

•

Deadend Tool

Deadend tool; shoes furnished to fit various types of deadend clamps, including thimble eye types; tool also equipped with cumalong. **James R. Kearney Corp.,** St. Louis.

A safe working load of 1,800 lb. maximum is said to be obtainable from a new deadend tool for handling deadends and other types of suspension insulator construction with not over six insulators per string. Tool employs a lever-and-fulcrum principle: rear rocker arm has a spiked shoe and strap to be fastened to a pole or crossarm, while the outer rocker arm is placed astride conductor with a suitable strain shoe bearing on end of deadend clamps. Rocker arm pivots are so arranged that tool is self-stabilizing as soon as pressure is applied.

•

Arc Welding Electrodes

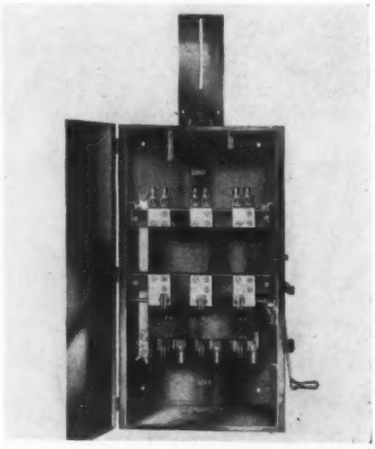
"Transweld" electrodes; in three sizes: 3/32, ⅛ and 5/32 in.; smallest size in 12-in. lengths, other two in 14-in. **The Lincoln Electric Co.,** Cleveland.

New mild steel arc welding electrodes, designed particularly for use with small a.c. transformer type arc welders, are said to simplify welding with this type of equipment and to provide weld metal of high quality. Having a stable arc, the electrode permits making smooth, well-shaped beads; slag is easily removed from deposits, it is said.

•

Current-Transformer Switches

Main switch and facilities for mounting a current transformer are included in one cabinet in these entrance switches. Bracket extending above the cabinet accommodates meter. Main fuses are accessible through a sliding door in cover only when switch is in "off" position.



"Colt-Noark" transformer switches; four-pole, three-fuse models in 200, 400, 600, 800 and 1,200 amp. capacities. **Colt's Patent Fire Arms Manufacturing Co.,** Hartford.

•

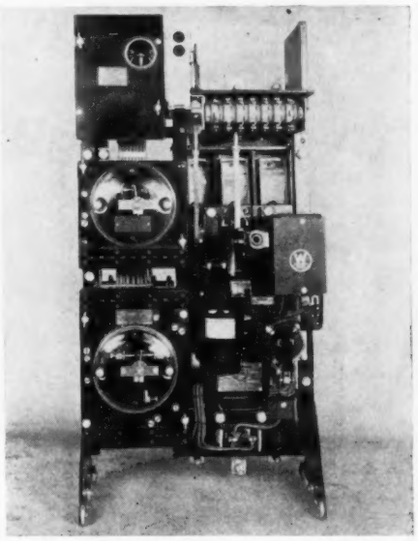
Electric Tubing

"Xduct Junior" electric metallic tubing. **National Electric Products Corp.,** Pittsburgh.

By an electroplating method a heavy coat of zinc is applied to the outside and inside of newly announced electric metallic tubing. Tubing is said to bend readily and maintain its coating: it is stated that tests have shown thickness of coat is sufficient to afford immunity to any corrosive conditions tubing will meet in use.

Network Protectors

Compactness and light weight are features of a new line of light-duty network protectors, said, nevertheless, to be durable, accessible for maintenance and positive in



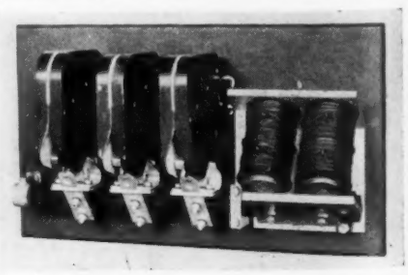
One of line of light-duty network protectors developed by **Westinghouse Electric & Manufacturing Co.,** East Pittsburgh.

operation. Moving element of master relays comprises a short shaft with single drum, around whose periphery are spaced three elements. Geared motor mechanism, of a type used on heavy-duty units, mounts on a frame in front of circuit breaker, engaging directly with an extension of breaker handle. Breaker may be operated manually, employs "De-ion" arc extinguishers.

•

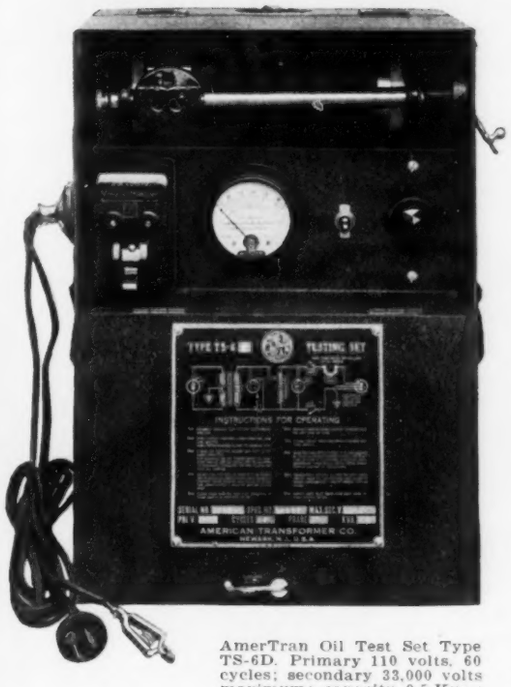
Humless Contactors

For use where noise reduction is important, a new line of d.c. operated a.c. contactors which will not hum during operation is offered. According to the makers, only a small amount of power is required to hold circuit closed; contactors are



Magnetic a.c. contactor with soft steel core; 300 amp., three-pole. **General Electric Co.,** Schenectady.

MERIT • •



AmerTran Oil Test Set Type TS-6D. Primary 110 volts, 60 cycles; secondary 33,000 volts maximum; capacity 0.5 Kva.; overall dimensions 16-in. x 12¼-in. x 12½-in.; net weight 75 lbs.; safety switch on door of oil-cup compartment prevents accidental contact with high voltage.

A complete oil-testing set

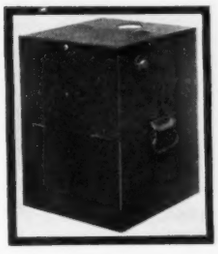
that is { accurate • portable / safe • inexpensive

Insulating oil in transformers and circuit breakers must be tested for dielectric strength at regular intervals in order to insure uninterrupted performance of electrical equipment. Assuming accurate testing apparatus, it is preferable to make such tests in the field—it saves time, avoids errors, prevents contamination of samples and reduces labor costs.

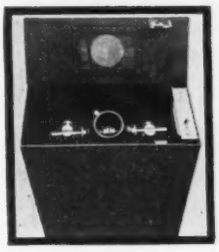
Portable apparatus of real merit for testing insulating fluids is the AmerTran Type TS-6—it offers all the advantages of a laboratory in one compact, light-weight unit. This set is complete with testing transformer, circuit breaker, voltage regulator, voltmeter, oil-cup and safety switch. Tests may be made in the approved laboratory manner and with laboratory accuracy. Further, the unit is both safe and foolproof, even in inexperienced hands. May we send descriptive literature?

AMERICAN TRANSFORMER CO.

178 Emmet St., Newark, N. J.



Closed and ready to ship with everything inside.



Rear view showing bakelite oil cup and door switch.

Write for Bulletin 1132

ADVANTAGES

Accurate results are assured when using a Type TS-6 Test Set, as the voltage is increased gradually (not in steps) from zero to maximum and the *exact* breakdown voltage is indicated by an accurate meter. It is the only standard portable set with which we are familiar designed to permit testing in this approved laboratory manner.

AMERTRAN TRANSFORMERS

Manufactured Since 1901 at Newark, N. J.

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The Solution to Your Pipe Pushing Problems

Hydraulic PIPE PUSHER

Here is a pipe pusher that permits one man to stand in a comfortable position and apply a pressure of 40,000 pounds to the pipe, simply by pumping one handle in the slow-speed position. It is an important time and labor saver for anyone having to make underground installations.

The Greenlee Hydraulic Pipe Pusher operates on a notched steel base, so that it is only necessary to change the pipe clamp once for each push of from 4 to 7 feet, depending on the length of base used. Pumping the handles sets up a pressure within two oil cylinders to push the pipe. This provides a smooth-acting, powerful mechanism that is flexible and exceptionally simple.

It will pay you to investigate this improved method of pushing pipe for electric cables, gas, water or any other purpose. Ask for complete information.

GREENLEE TOOL CO., 1705 Columbia Ave., ROCKFORD, ILL.

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LONG LEAF POLES

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You'll identify DIXIE Long Leaf Poles by this symbol stamped on each.

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A CROSSETT WATZEK GATES INDUSTRY

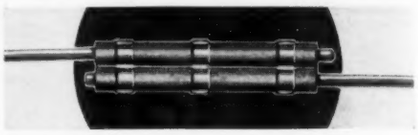
JACKSON LUMBER COMPANY POLES DIXIE PILING LOCKHART, ALABAMA

unaffected by normal voltage variations; current-carrying parts are conservatively rated at 600 volts on eight-hour basis; they can be used on either a.c., through rectifiers, or directly on d.c. Contact tips are of heavy copper.

•

Compression Wire Joint

Splices and deadends may be made quickly and uniformly, it is said, with an extra strong deoxidized copper double tube



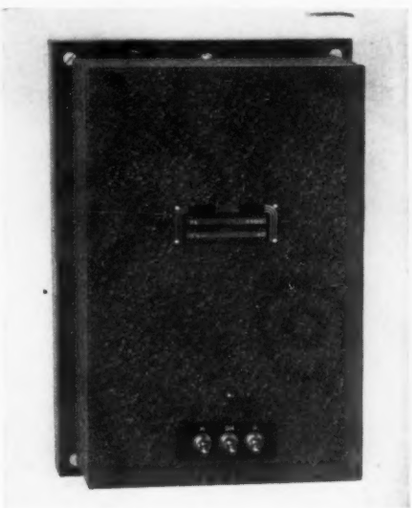
"Western Union" compression wire joint; available for Nos. 6, 8, 9 and 10 B.&S. and for 8, 10 and 12 B.W.G. wires. **Reliable Electric Co.,** Chicago.

splicing sleeve used in a new compression wire joint. Cleaned wire ends are pushed through the sleeve, which is then pressed in three places with a small, light tool. Resulting joint is stated to be gas-tight even under most corrosive atmospheric conditions, holding point resistance constant.

•

Voltage Regulator

Quick response to load changes is said to be assured by a new voltage regulator of the vibrating contact type through the elimination of rolling or sliding friction



Vibrating type voltage regulator. **Ideal Commutator Dresser Co.,** Sycamore, Ill.

and the absence of dashpots requiring periodic maintenance. Regulator maintains correct a.c. voltage on generator by alternately opening and closing a set of rheostat shunting relay contacts across excited field rheostat. Relay contacts are controlled by main control element, the time they are closed as compared with time they are opened determining exciter armature voltage, which maintains correct generator voltage.

•

Temperature Controller

Close temperature regulation for heat-treating furnaces and similar applications is said to be provided by this throttling potentiometer controller, which controls throttling valve to regulate fuel flow and hold temperature constant within throttling range. To the familiar potentiometer-pyrometer circuit, the device adds a second

The 1937
McGRAW CENTRAL STATION DIRECTORY

Here are the Contents

Names and addresses of independently owned electric light and power companies in the United States, Canada and United States Possessions.

Names and addresses of municipally owned electric light and power systems in the United States, Canada and United States Possessions.

Names and addresses of affiliated, holding, controlling or managing companies with complete lists of properties controlled or managed by each.

Names and addresses of principal officials of holding and managing companies.

Names and addresses of officials and chief operating men for all operating companies including:

Presidents
Vice Presidents
General Managers
Chief Engineers
Electrical Engineers
Mechanical Engineers
General Superintendents
Plant Superintendents
Plant Engineers
Superintendents of Distribution
Superintendents of Transmission
Commercial or New Business Managers
Merchandising Managers
Purchasing Agents
Division or District Managers
Division or District Superintendents
Division Merchandising Managers

For each operating company the following information is presented:

Generator Capacity in kva. or kw.
Kind of Prime Mover and Capacity in hp.
Amount of power purchased in kw.-hrs.
Type of current distributed, number of wires, phase and cycles.
Number of meters served.
Location of power plants.
Location of districts or divisions.
Complete list of towns (having a population of 500 and over) served.

National and State Public Utility Commissions with addresses, names of commissioners and principal assistants.

A complete alphabetical index of companies and municipal systems giving location by city and state.

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Here, in this handy volume, you will find—easily and quickly—valuable information on every light and power company in cities of 500 or more population in the U.S., Canada and U.S. possessions.

The more than 800 pages of handy facts are arranged alphabetically by states and thumb-indexed to facilitate use. Note at the left the type of information that will be constantly at your finger tips. Size—4½" by 8¼", bound in tough, flexible covers that resist wear.

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INSULATORS

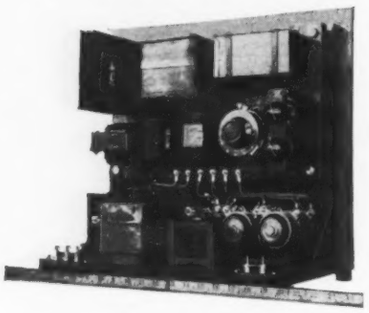
DESIGNED TO MEET EVERY DISTRIBUTION LINE REQUIREMENT

• A rugged design, consistent in shape, neat, strong, and compact with high electrical values. Each size takes a wide range of conductor sizes. Made from the same high grade porcelain as is used in the manufacture of the larger high voltage insulators.

We make a wide variety of insulators for power transmission and distribution. Our large stocks and central location enable us to make unusually prompt shipments.

ILLINOIS ELECTRIC PORCELAIN COMPANY
MACOMB - - - - ILL.

ROLLER-SMITH *Announces*



The
***New Type* REF**
AUTOMATIC
VOLTAGE
REGULATOR

This new device has no moving parts, no moving contacts, no tubes. In fact it will last a lifetime without any maintenance expense and without any attention.

This Roller-Smith REF AUTOMATIC VOLTAGE REGULATOR provides a source of constant voltage for many laboratory and production applications such as meter testing, life tests on lamps, instrument calibration, etc.

Available now in 1, 2½, 5, 7½ and 10 KVA sizes.

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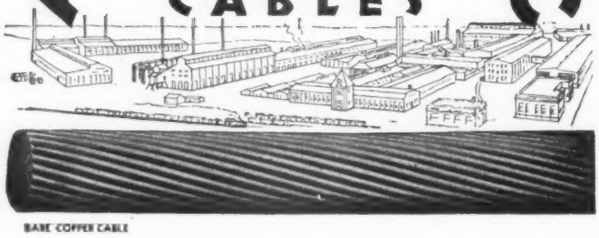
WIRES AND CABLES



BARE COPPER CABLE

POWER CABLE
PAPER INSULATED
VARNISHED CAMBRIC INSULATED
TELEPHONE CABLE
BARE COPPER WIRE AND CABLE
WEATHERPROOF WIRE AND CABLE
MAGNET WIRE
TROLLEY WIRE

"QUALITY ABOVE SPECIFICATIONS"

KENNECOTT WIRE AND CABLE COMPANY
SUBSIDIARY OF KENNECOTT COPPER CORPORATION
PHILLIPSDALE, RHODE ISLAND
New York, 10 East 40th St. - Chicago, 140 South Dearborn St. - Cincinnati, Traction Bldg.

slide wire in the control circuit for smoother operation. Reset adjustment enables operator to change or "reset" relationship be-

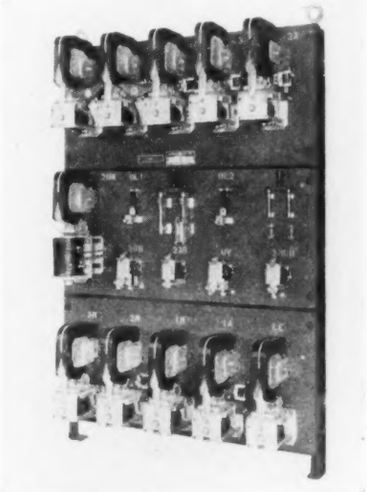
Model 4039 Throttling Reset Controller. **The Foxboro Co.,** Foxboro, Mass.

tween valve position and instrument for given temperature, making it possible to maintain selected temperature over wide range of operating conditions and requirements.

•

Crane-Hoist Control

High lowering speeds, excellent speed regulation, precise spotting of the hook, protection of both motor and brake from abuse and maximum safety for operating



D.c. crane-hoist control. **General Electric Co.,** Schenectady.

crew are features claimed for a new d.c. crane-hoist control which employs rocker-bearing contactors and magnetic-time relays. Regenerative braking is obtained for any load requiring 30 per cent or greater braking effort, making for economical power consumption; dynamic braking is available for emergency stops. Automatic control of acceleration and deceleration is provided by magnetic time relays.

•

Line Truck Body

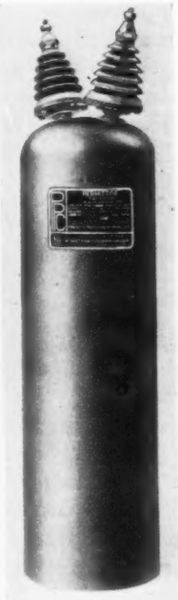
Light weight, rugged construction and durability are said to be dominant features of a new line construction and maintenance body. Standard equipment includes combination pole derrick hinges, spindle bar brackets and other derrick parts, snatch-block eyebolt, safety hook, wheel chock carriers, eccentric ladder clamps, seat forming

winch cover, material rails for coils of rope and wire, digging-bar racks, pike pole racks and space for carrying spoons, shovels and other tools.

Type HCW; 128 in. long by 88 in. wide, excluding fenders; for mounting on any truck chassis having standard cab to axle dimension of 84 in. **Highway Trailer Co.**, Edgerton, Wis.

•

Distribution Capacitors



Small, single-phase, unit type distribution capacitors for pole mounting employ aluminum foils separated by condenser tissue in an atmosphere of compressed nitrogen. Layers of insulating paper are wound with aluminum foil into circular coils — each coil being a single-phase condenser element—which are assembled concentric with tank shell on axial supporting member. Flanged end plates cover ends of coils. Compressed nitrogen is said to produce a medium of high dielectric strength and minimum dielectric losses.

Type U "Permittors"; in ratings of 10, 15, 20, 25 and 30 kva. at 2,300, 4,000, 4,600 or 6,900 volts, 60 cycles, and correspondingly reduced ratings at other frequencies. **Products Protection Corp.**, New Haven.

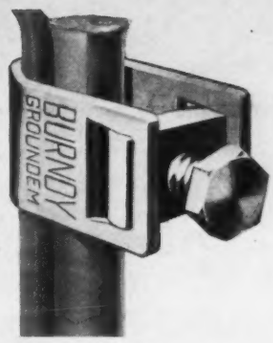
•

TECHNICAL BULLETINS

HAYNES STELLITE—"The Haynes Stellite Library," published by Haynes Stellite Company, Kokomo, Ind., lists and briefly describes eighteen Haynes Stellite publications dealing with hard-facing alloys, cutting tools and alloys for chemical processing equipment. Literature is grouped under four heads with regard to information for the machinist, the welder, the metallurgist and for general maintenance.

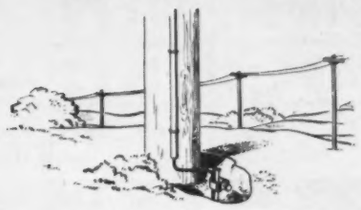
GROUND RESISTANCE TESTING—Measurement of the resistance to earth of ground connections, with special reference to the "Megger" ground tester, is taken up in Technical Bulletin 1285 of the James G. Biddle Company, 1211-13 Arch Street, Philadelphia. Ground resistance curves, various methods for testing ground desistance, theoretical value of resistance to earth of ground connections are subjects included in the discussion.

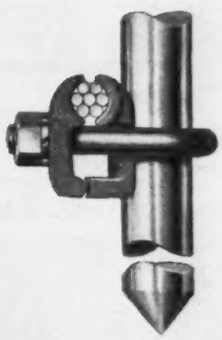
BURNDY
Ground CONNECTORS



BURNDY GROUNDEM TYPE GH

For clamping ground conductor to driven rod. Slips over top of rod or around conductors. Sturdy; non-corrosive.



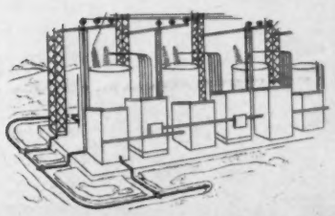


BURNDY GROUNDEM TYPE GR

For joining ground bus at right angles to driven rod or pipe. U-bolt, nuts, lockwashers of non-corrosive Everdur.

BURNDY GROUNDEM TYPE NT

For tapping cables from main grounding cable to apparatus, electrodes or grounds. Supplied for all conductor combinations.



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Electroline
AUTOMATIC
TROUBLE-FREE
DEPENDABLE
TIME PROVED
LINE SPLICES

• Our largest customers started using Electroline automatic line splices YEARS AGO. And are CONTINUALLY INCREASING THEIR USE. Why? Because they have proved dependable under all conditions of service in every climate and country over a long period of years. There is no reason for using questionable imitations.

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Originators and Patentees of Automatic Line Splices and Dead Ends
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SPECIFIED BECAUSE OF PROVED PERFORMANCE

Crapo Galvanized Steel Strand has earned its enviable reputation for long, dependable, economical life by outstanding performances in actual service. That's why it so often is specified by leading utilities for the more important construction jobs. The heavy, uniform, pure zinc coating—applied by the *Crapo* Process—is notable for its adhesion and ductility; its ability to withstand bending and twisting; its lasting resistance to corrosion. Both the finished strand, and the wire from which it is made, conform in every detail to the most rigid specifications for tensile strength, elongation, size, galvanizing and ductility.

Crapo Galvanized Strand is readily available in all standard grades and sizes. Ask your Jobber, or write direct for technical details!

Largest Accounting Center

What is said to be the world's largest public utility customer's accounting center was opened recently by the Consolidated Edison Company, Inc., of New York at 111 East Sixteenth Street. As reported in *Around the System*, the center handles a $100,000,000-a-year accounting business, of which amount electricity sales represent $79,700,000. It takes care of commercial relations accounting work for 650,000 gas and electric customers, with 1,375,000 meters.

•

Knapp-Monarch Plan Ratified

Stockholders of Knapp-Monarch Company at the special meeting held recently ratified the proposal to issue 48,702 shares of common stock at $15 per share. No date has been fixed as yet for the offering to stockholders, which will be on the basis of one new share for each 2½ shares held, or for subsequent offering to the public. The registration was filed recently with SEC.

•

Funds for Municipal Plants

Colombian (South America) Congress has voted grants-in-aid totaling 125,000 pesos (approximately $71,300) to some fifteen municipalities for construction of municipal electric light and power plants, reports the U. S. Department of Commerce.

The law making such grants available provides that they will be paid on the express conditions that the electric plants are municipally operated and that the municipalities contribute not less than 30 per cent of the total cost of construction.

•

Opens Vacuum Cleaner Drive

Apex Rotarex Corporation has started a national cleaner merchandising and promotion campaign, featuring an offer of an 8½ x 11-ft. imported Oriental type rug to be given away with each purchase of a cleaner at $39.95 and up, J. M. Michael, eastern division sales manager, has announced. All the large metropolitan stores handling the Apex cleaner will participate in the campaign. The merchandising program will include special prizes for salespeople.

Sales Opportunities

RIVERSIDE, CALIF.—Nevada - California Electric Corporation, Riverside, plans new power substation at Kramer Crossing for terminus for 138,000-volt transmission line from Boulder Dam hydro-electric generating station of Federal Government. Installation will include four 12,500-kva. power transformers, high-voltage switching equipment and accessory apparatus. New station will reduce voltage to 95,000 volts for line transmission, and will be tied in with power substation at Victor with three existing transmission circuits leading to San Bernardino, Calif., and vicinity. Entire project will cost about $500,000.

WYANDOTTE, MICH.—Michigan Alkali Company, Wyandotte, plans expansion in power plant, with installation of additional generating equipment and auxiliary apparatus for service at new plant unit for production of chlorine and caustic soda, utilizing an electric process for which rights have been secured from the Imperial Chemical Industries, Ltd., London, England. Plant installation will include motors and controls, switchgear, regulators, conveyors and other equipment, with facilities for initial capacity of 100 tons of chlorine and 120 tons of caustic soda per day. Cost about $1,000,000. Work is scheduled to begin soon.

CLEVELAND, OHIO—Department of Public Utilities, City Hall, is considering report made by Peter F. Loftus, Oliver Building, Pittsburgh, Pa., consulting engineer, for expansion and improvements in municipal power plant on Fifty-third Street, following recent survey. Project calls for gross expenditure of about $5,300,000 over period of 60 months, including immediate installation of new boiler plant and coal-handling equipment at cost of $441,870; following, extensions and betterments in generating division, with installation of new turbo-generator unit and accessories with rated output of 15,000 kw. under present steam pressure, and 25,000 kw. when high-pressure steam is available, cost $2,130,600; three new high-pressure steam boilers and accessories, cost $2,726,950, and addition to station to house new equipment. Frank O. Wallene is director of department.

BATON ROUGE, LA.—Ethyl Gasoline Corporation, 135 East Forty-second Street, New York, N. Y., plans installation of motors and controls, conveyors, transformers and accessories, and other equipment in new multi-unit plant at Baton Rouge for production of chemicals used in high-test gasoline compounding. It will be located on site adjoining present Ethyl fluid works of company at that location. Cost close to $4,500,000.

BLUFFTON, IND.—Board of Public Works receives bids until December 7 for extensions and improvements in municipal power plant, including 400-hp. boiler unit and accessories, superheater, soot blower, etc. B. H. Freeland, superintendent of station, is engineer in charge.

ADRIAN, MICH.—Southeastern Michigan Electric Company, Adrian, has plans under way for new electric generating plant on local site, with extensions in transmission and distributing lines.

CHICAGO, ILL.—Regensteiner Corporation, 310 South Racine Avenue, plans installation of motors and controls, regulators, conveyors and other equipment in new two-story printing plant, 176 x 179 ft., at 1224-40 West Van Buren Street. Cost about $200,000. Alfred S. Alschuler, 28 East Jackson Boulevard, is architect.

PENSACOLA, FLA.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for automatic telephone system at Naval Air Station, Pensacola (Specifications 8558).

CEDAR RAPIDS, IOWA—Iowa Electric Light & Power Company, Cedar Rapids, plans extensions in transmission lines in part of Linn County. Application has been made for permission.

NORFOLK, VA.—Has authorized plans for new municipal electric power plant at South Norfolk, and will take bids for equipment at early date. Cost about $330,000. Wiley & Hughes, Peoples' National Bank Building, Lynchburg, Va., are consulting engineers. (City has rejected proposition to furnish light and power service made by Virginia Electric & Power Company, Richmond, Va.).

ENKA, N. C.—American Enka Corporation, Enka, near Asheville, N. C., plans installation of motors and controls, conveyors and other equipment in new additions to rayon mill. Cost close to $500,000. Work will begin soon. Main offices are at 271 Church Street, New York N. Y.

LOS ANGELES, CALIF.—Metropolitan Water District, 306 West Third Street, receives bids until December 13 for telephone exchange equipment for installation at Colorado River Aqueduct pumping plants (Specifications 248).

DES MOINES, IOWA—Des Moines Electric Light Company has approved plans for new addition to steam-electric generating station on river front, vicinity of West Grand Avenue, estimated to cost about $50,000, exclusive of equipment. Erection award has been made to the Weitz Company, Inc., 713 Mulberry Street, Des Moines. Work is scheduled to begin at once.

CORPUS CHRISTI, TEX.—Amsco Refining Company, West Broadway, plans installation of motors and controls, conveyors, electric pumping machinery and other equipment in new addition to oil refining plant, to double present capacity. Cost over $400,000.

MARLOW, OKLA.—Plans extensions and improvements in municipal electric power plant, including installation of new 700-hp. Diesel engine-generator unit and auxiliary equipment.

RIVERSIDE, CALIF.—Citrus Machinery Company, Twelfth Street and Pachappa Avenue, plans installation of motors and controls, conveyors, electric hoists and other equipment in new packing house machinery plant. Cost close to $100,000.

•

Imperial District Contracts

Imperial Irrigation District, El Centro, Calif., has awarded a contract to the Newport News Shipbuilding & Dry Dock Company for a 13,300-hp. hydraulic turbine, with 12-ft. diameter wheel, including governor and accessory equipment, at a price of $120,918. This unit will be installed in new hydro-electric generating station to be constructed by the district at Drop No. 4, All-American Canal. An award for a 12,000-kva. generator unit for the plant has been made to the Elliott Company, Pittsburgh, Pa., at a price of $119,450.

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• Electrical Engineers concerned primarily with design and specifications . . . Operating Men, Plant Managers and Superintendents responsible for the proper functioning of equipment . . . Central Station Men interested in load building — are looking forward to an important forthcoming event, . . . the Fifth International Heating & Ventilating Exposition, featuring AIR CONDITIONING

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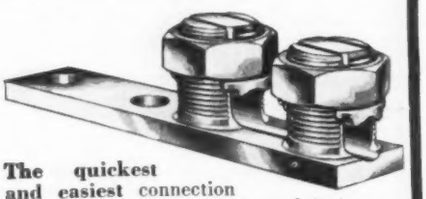
A truly "universal" lug, because each size can be used for a wide range of wire and cable sizes.



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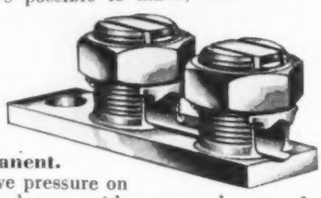

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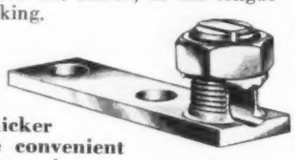

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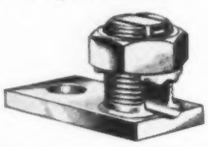

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Congress May Force President to Bend

[*Continued from page 68*]

trol of the party, write the platform and name the candidate at the 1940 convention, and, with honeyed words, slide the New Deal into limbo.

It would seem that the choice would not be difficult to any politician as shrewd as Mr. Roosevelt. But there is a complication. Many of his advisers have *never* thought the Roosevelt policies would really work, have always thought that they would gradually undermine the capitalistic system and so pave the way to the form of government they really want. This group, which is highly influential, would like to see the present business trouble worse, instead of better as Roosevelt himself wants it. So they will do their utmost to encourage the President to stand his ground. They are counting on his stubbornness. And as this is written they are very optimistic.

•

New Course Given at Case

A new course, "Matrices in Electric Circuit Theory," is being given at Case School of Applied Science this year by Dr. Richard S. Burington. The course is designed for graduate electrical engineers who wish to study the mathematical and physical background essential to a complete understanding of the current research literature in electrical engineering.

•

Pays Electric Range Bonus

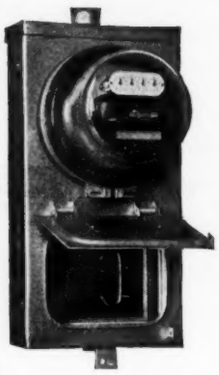
Kansas City Power & Lighting Company is paying a bonus of $5 to its employees for electric range prospects filed with the Electric Association of Kansas City between November 1 and December 20, inclusive. The purchase must be made within 90 days from the date of filing.

•

Taxes on Wisconsin Utilities

Wisconsin's 136 public and private utilities have a taxable value of $338,587,800 this year, as against $334,812,250 for 1936, according to the state Tax Commission. Taxes to be paid by these utilities will total $7,816,975, an increase of $410,059 over 1936. These figures compare with a property valuation of $331,304,650 and tax levies of $7,334,050 in 1935.

If WALKER CABINETS Could Talk . . .



They Would Say—

"Ours is a simple job, but important. We do not consist of delicate mechanisms, but are built of rugged rust-proofed steel and aluminum by masters in the manufacture of steel and aluminum cabinets and boxes for all types of electrical installations. Our job is to protect, and we do it well — year in and year out — economically and with minimum attention."

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A postcard will bring you complete information.

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Atlanta, Ga.

Hydro Project Cost Fixed at $20,123,970 by Commission

In a finding and order made public by acting Chairman Clyde L. Seavey, the Federal Power Commission has approved and allowed as the actual legitimate cost of the large power project of the Lexington Water Power Company on the Saluda River, near Columbia, S. C., as of June 30, 1932, the sum of $20,123,970.

Of the $21,648,232, representing the licensee's claim of the cost of the project, a total of $1,524,261, is disallowed.

The project is situated on the Saluda River about 10 miles above Columbia, S. C., affecting lands in Lexington, Richmond, Newberry and Saluda counties. The power house is in four units with an installed capacity of 180,000 hp.

•

Utility Wins Safety Prize

Making use of a line truck and a street-lighting service truck, the Indianapolis Power & Light Company entered two floats in the recent city-wide safety parade and won first prize. Importance of lighting to public safety, particularly at street crossings and on highways, was stressed by the company in the parade which climaxed a week of safety activities in this city. The theme of the prize-winning float was "Look to Light for Safety."

•

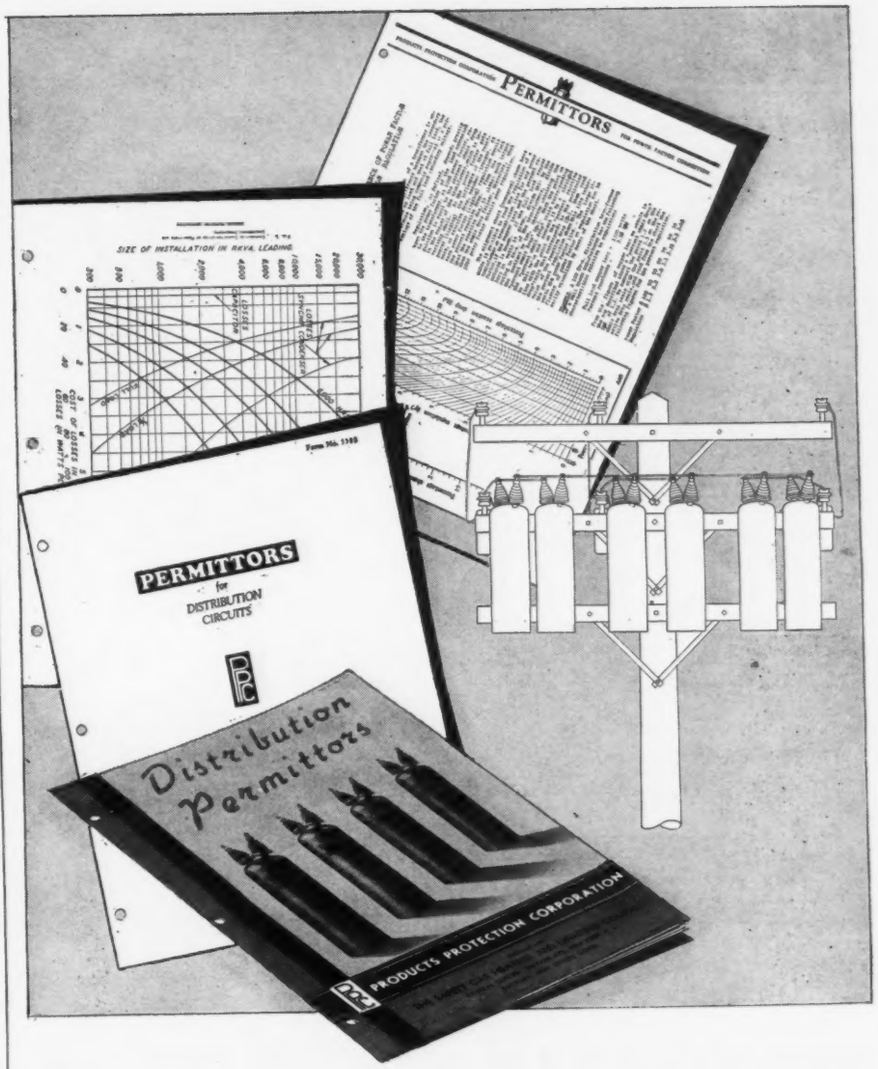
Probe Set on Hydro Project

Federal Power Commission has ordered that a hearing be held on December 7 upon fixing the power capacity and annual charges due and upon a recomputation of the annual charges of Project No. 708, in California, of which the Pacific Gas & Electric Company is the licensee. This project is located on the Stanislaus River in Calaveras and Tuolumne counties.

•

Lets Regulator Contracts

Los Angeles Water and Power Commission has awarded a contract to the General Electric Company for twenty-four 75-kva., 60-cycle feeder voltage regulators, at a price of $62,-704. Also, to Westinghouse Electric & Manufacturing Company for six 150-kva., 60-cycle feeder voltage regulators at $23,035.



DISTRIBUTION PERMITTORS

Are now available in sizes from 10-kva to 120-kva per single unit. The larger sizes from 45-kva to 120-kva are, as in the past, either single or three-phase. To meet the demand for small single phase units, the U series of Distribution Permittors is offered in sizes of 10, 15, 20, 25 and 30-kva, 2300-volts and up. These are fully described in our new booklet #3582. Send for your copy.

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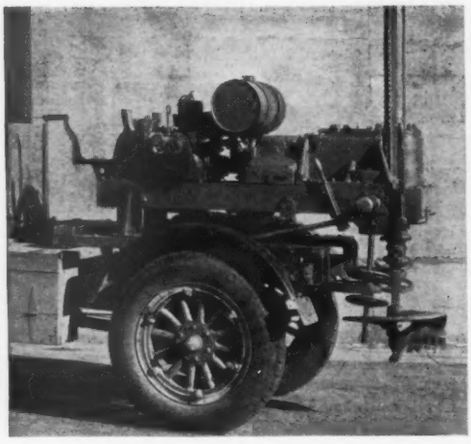


Truck-mounted type—suitable for mounting on job on any standard truck.

• Don't let frozen ground double your pole hole digging cost. BUDA-HUBRON drills have long proved the low cost way to handle the job regardless of size. Low initial cost, portability and dependable, rapid action combine to give full economy on even one or two pole replacement work.

In the Muskeg swamps of the north, where digging is "stymied" until the ground is frozen, Buda-Hubron drills are the answer to pole setting problems—have produced unparalleled operating results.

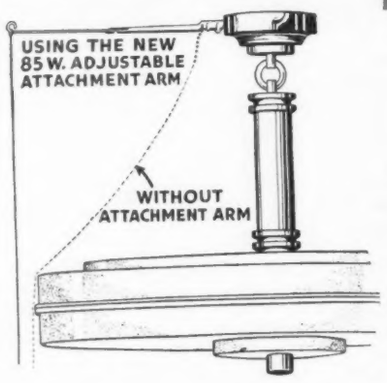
Buda-Hubron Pole Hole Drills mounted on tractor, truck or trailer, drill holes to 42 in. in diameter, or to 50 feet in depth. Drills holes 6 feet deep in 3 minutes.

Send for Bulletin 868-13

THE BUDA COMPANY, HARVEY (CHICAGO SUBURB) **ILLINOIS**

New!

Every fixture with a wide bowl and lamp cord needs the McGILL Extension Arm. Slipped over the Levolier Switch lever and tightened, the arm prevents wear and possible breaking of cord and bowl, and eliminates strain on the fixture. It is an added economy and adds to the life of the switches. Order from your wholesaler.



Made of metal 1/32-inch thick, and formed for additional strength and rigidity. Closed, 5¼ inches. Extends up to 9½ inches.

McGILL *Levolier* Extension Arm (No. 85W.)

McGILL MANUFACTURING COMPANY

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Recent Rate Changes

ARKANSAS POWER & LIGHT COMPANY has made an agreement with the State Utilities Commission whereby the company will reduce residential, commercial and small power rates to effect a total savings of $270,000 annually to its customers in those classifications. New rate schedules will be effective February 1, 1938.

VIRGINIA ELECTRIC & POWER COMPANY has agreed to a reduction of its rates for North Carolina customers, amounting to approximately 6 per cent, the North Carolina utilities Commission announced after a recent conference with representatives of the utility. Edgar A. Womble, commission utilities rate expert, said the lower rates, to be effective January 1, would result in a saving of approximately $24,000 a year —$11,000 for residential users and $13,000 for commercial customers. The company has recently reduced its rates to Virginia consumers $250,000 (ELECTRICAL WORLD, November 20, page 108).

WISCONSIN GAS & ELECTRIC COMPANY has reduced rates affecting 7,500 commercial and industrial customers to the amount of $90,000. Under the new rate for commercial customers, the first 250 kw.-hr. will cost 4½ cents per kilowatt-hour in Kenosha, Waukesha, Burlington, Fort Atkinson, Watertown, West Bend, Barton and Whitewater. Elsewhere the rate will be five cents. The new scale is gradually stepped down to as low as 2½ cents per kilowatt-hour on all consumption over 3,000 kw-hr. per month.

SOUTH CAROLINA UTILITIES COMPANY has reduced its electric rates approximately $13,000 annually. The new rates will go into effect on all bills rendered after December 1. The new schedules were adopted after lengthy conferences between officials of the company and members of the commission. The new residential rate is as follows: First 12 kw.-hr., $1 (minimum charge); next 28, 7 cents each; next 60, 4 cents each; next 150, 2½ cents each; all in excess of 250, 1½ cents each. Under the old residential rate the minimum charge was $1.10; the first 30 kw.-hr. were 10 cents each; next 70-kw.-hr., 3¾ cents each, and all in excess of that amount, 2½ cents each. The new commercial rate is as follows: First 12 kw.-hr., $1.20 (minimum monthly charge); next 88, 9 cents each; next 500 4½ cents each; next 2,400, 3 cents each, and all in excess of 3,000, 2½ cents each. The old commercial rate was $1.25 (minimum monthly charge); first 50 kw.-hr., 10 cents each; next 50, 9½ cents each; next 800, 4½ cents each; 4,100, 4 cents each, and all in excess of that amount, 3 cents per kilowatt-hour.

BELLEFONTAINE, OHIO, city council has cut electric rates 11 to 18 per cent.

•

Utility Has "Customer Room"

Florida Public Service Company, Orlando, which this year celebrates fifty years of service, recently opened a new office building. In the rear of the display room, which features a modern kitchen, is "The Customer Room," designed to provide a meeting place for out-of-town customers of the company. It is also offered to the Orlando public as headquarters for committee and club meetings.

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Municipal Plants

GUNTERSVILLE, ALA.—Alabama Supreme Court has dissolved a temporary injunction restraining the city from building a municipal power system, holding it had "full legislative authority to that end." The decision was against the Alabama Power Company, which attacked the sale of $134,000 in bonds and the proposed construction as unlawful. The power company charged that the city was attempting to construct a competing system without compensating the company for the losses it would sustain.

TRENTON, MO.—United States Court of Appeals has ruled it will hear an appeal of the Missouri Public Service Company from the dismissal by Federal Judge Otis of Kansas City of a restraining order against the construction of a $250,000 municipal light plant. The city and Fairbanks, Morse & Company, which supplied equipment for the municipal plant, had asked for dismissal of the utility's motion on the ground the plant was completed and placed in operation and there was nothing for the court to decide. The Court of Appeals stated in part that in view of the fact arguments on the appeal have been set for December 7, the wisest procedure would be to refuse the motion of the municipality and Fairbanks, Morse and to hear the appeal.

REPUBLIC, OHIO—Village Council and citizens are considering the sale of the municipally owned electric lighting system to the Ohio Power Company, which is willing to purchase the lines at a figure to be determined later, upon appraisal value. The utility would furnish energy at 5 cents per kilowatt-hour for the first 30, whereas the rate under the present system is 8 cents each for the first 25 kw.-hr. A 50-cent monthly minimum charge would be established as compared with the present 75-cent minimum charge. Village now buys its electric energy at wholesale rates from the Ohio Power Company.

JACKSON, TENN.—An appeal from his decision denying the West Tennessee Power & Light Company an injunction to restrain the city from subscribing for TVA power was allowed the power company by Judge Martin in federal court. Judge Martin recently refused the injunction application on the grounds that the power company's long-term contract, giving it sole and exclusive rights to distribute power and light in the city, was in violation of state statutes. The application for appeal claims the court erred in holding that the city had not precluded itself from entering into the power business by the contract. It also claims the court erred in ruling the city had the right to erect and operate distribution lines. The power company holds a contract to serve Jackson until 1963. The injunction proceedings were started to enjoin the city from building power plants and distribution lines for TVA power.

STAUNTON, VA.—With the Virginia Public Service Company's franchise expiring next August, City Council has instructed City Manager W. L. Hall to make a survey of the situation from three angles: contact the public utility corporation to see if its rates will be lowered substantially voluntarily; invite bids from other interested parties, perhaps including the REA, which is erecting a plant at Dayton, and study the cost and feasibility of reconditioning and enlarging the municipal plant, which has been idle during recent years while the city purchased electricity from Virginia Public Service for municipal purposes, including street lighting.

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It's FREE *to Executives*

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Better Protection for High-Voltage Motors

[*Continued from page 56*]

motor. Such a fusing practice not only takes care of the proper coordination of the fuse and the overcurrent tripping of the contactor but also insures against the blowing of the fuse link on motor starting currents.

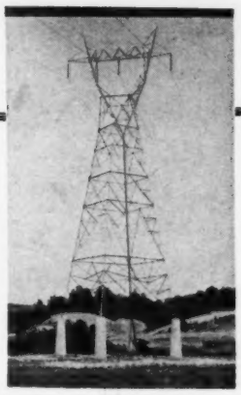
Oil fuse cutouts are specifically mentioned by the National Electrical Code in giving approval to the use of fuses for back-up protection to contactors and for other industrial applications. Besides being thoroughly investigated, including tests with various ratings of control equipment, they were demonstrated to the Article 50 Committee, which approved their use in recommending the changes in the 1931 issue of the Code and extended their possible application in the 1935 Code.

Sturdy housing confines all forces

Oil fuse cutouts have a distinct advantage over the many designs which function on the expulsion principle, since all of the forces are confined within a sturdy housing. Protection is thus afforded to equipment in the vicinity by preventing the danger of fire and the external flashover between phases or to grounded parts. They function without making the customary explosive noise attendant upon circuit interruption with expulsion type fuses and thus avoid the danger of accidents and spoiled work due to startled operators. The renewal of fuse links is very simple and comparatively low in cost.

Cutouts may be used as disconnecting switches, opening the circuit with current flowing up to the full current rating of the fuse cutouts. If the operator should accidentally replace the fuse links and close the circuit before the fault has been completely cleared he is afforded ample protection against accidents since the fuse carrier is locked in place before the circuit is closed.

The use of oil fuse cutouts for the protection of motors and control equipment and for other industrial applications has a background of nearly ten years' successful operating record in industrial plants. These cutouts also have been employed by the utility companies for a period of seventeen years for some of their most severe duties, on poles, and in



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manholes, where they are subjected to complete submersion, and in faults within buildings. Experiences reported by industrial concerns employing the cutouts for short-circuit "back-up" protection have shown a marked reduction in maintenance expense.

Damage to the control equipment has been practically eliminated so that they are repeatedly put back into service immediately. Destructive burning at the point where the fault occurs has been minimized. The outages have been confined to the individual motor, thus keeping loss in revenue from stopped production as low as is possible. With such a background the application of oil fuse cutouts affords all of the foregoing benefits at a price which, in many instances, is lower than the over-all cost of installations without the use of such cutouts.

•

Technical Writing Course

The Extension Division of the University of Wisconsin, at Madison, is offering a home-study course in Composition of Technical Papers, a course described as adapted especially to the requirments of active technicians desiring to increase their proficiency in writing business letters, reports and articles for publication.

•

New EHFA Contracts Closed

Electric Home and Farm Authority has anounced that contracts have been closed with the Southside Electric Co-operative, Blackstone, Va.; Shenandoah Valley Electric Co-operative, Harrisonburg, Va., and Loup River Public Power District, Columbus, Neb.

•

Canadian Electrical Output Shows Decline in September

Electrical output by Canadian central stations totaled 2,195,291,000 kw.-hr. in September, 1937, compared with 2,197,725,000 kw.-hr. in August and 2,041,423,000 kw.-hr. in September, 1936, according to the Dominion Bureau of Statistics.

Exports to the U. S. dropped to 143,441,000 kw.-hr. from 162,617,000 in August and 125,127,000 in September, 1936. Deliveries of secondard power to electric boilers decreased to 487,348,000 kw.-hr. from 491,409,000 in August and 498,474,000 last September.

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Klein "Lightweight" Climbers are built to the minimum weight possible consistent with maximum safety. Every pair is tested exactly the same as are the old time tried Standard Climbers. The lineman can throw his weight on these climbers with confidence —they are Klein's!

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The four pamphlets listed below will be sent without charge to anyone interested. Check the ones you want:

- ☐ Lightweight Climbers.
- ☐ Specifications on Linemen's Belts and Safety Straps.
- ☐ Klein Kord Fabric Safety Straps.
- ☐ Pocket Tool Guide.

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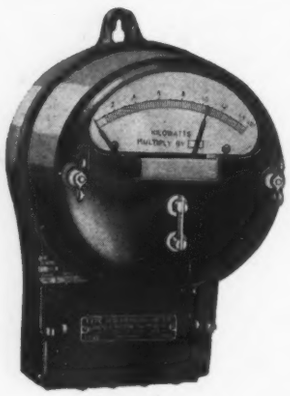

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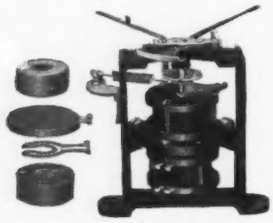
As simple in construction as an ordinary indicating meter. The chief difference is that, the Lincoln Demand Meter is time lagged to a large degree, while an ordinary indicating meter is practically instantaneous.



View of actuating element and parts

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Modern—dependable—correct design—long service and all around economy. A standardized line that has earned approval from coast to coast. Flat contact surfaces—interior and exterior smooth as glass. Made of seamless copper tubing. Interchangeable with your present power apparatus cast lugs.

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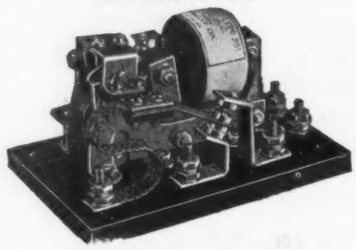

Catalog on Request

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15 E. 26th St., NEW YORK CITY

Fuse Primaries Even When Using Reclosers

[*Continued from page 60*]

When the value of l is such as to make the function Z a minimum or maximum, $\frac{dZ}{dl}$ will equal to zero.

$$dZ = -P\ (1 - K)\ f\,dl + P'\ f\ dl + 2\lambda\ f\ l\ dl$$

$$\frac{dZ}{dl} = -P\ (1-K)f + P'\ f + 2\lambda\ f\ l = 0$$

$$l = \frac{(1-K)\ P - P'}{2\lambda}$$

Since $\frac{d^2Z}{dl^2} = 2\ \lambda\ f$, which is a positive quantity and not a negative, the above value of l makes the function Z a minimum and not a maximum. There being no other roots of l, there can be no other value which will make Z a minimum. Therefore, the ideal location for a first position fuse is given by the formula,

$$l = \frac{(1-K)\ P - P'}{2\lambda}$$

Application of the locator formula

Although the derivation of this formula seems rather involved its application is a simple matter, the calculations involved being such as can be executed mentally. In the accompanying illustration is shown a typical feeder circuit, in which the ideal location of each first position fuse may be determined.

Assume $K = 0.65$
Then $P = 400$, and
$(1 - K)\ P = 140$

It is apparent that Stuyvesant is a strategic location for second position fuses, because the circuit divides at that point. It is therefore permissible to measure "l" from Stuyvesant back toward Kinderhook. (See definition of "L" and "l" above). Then,

$P' = 40$

$\lambda = \frac{50}{5} = 10$, and

$l = \frac{140 - 40}{2 \times 10} = 5$

Fused at origin of branch

Since this branch is just 5 miles long, the correct fuse location is at Kinderhook, the origin of the branch.

In the case of the two other branches originating at Kinderhook, the total lengths are not given. This data is not needed because the total load on either branch is less than $\frac{(1 - K)P}{2}$ or 70 kw. In such a case the branch may always be fused at its origin and further calculations are unnecessary.

As a check, the section from Kinder-

hook back toward Valatie may be inspected: Here $P' = 155$, which is greater than $(1 - K)P$ so that "I" would be negative. This is in agreement with what has already been determined; *i.e.*, that the first position fuses should be beyond the Kinderhook junction.

Modified prevailing practice

The reclosing equipment may be used to its best advantage even though it is not reaching out to the limit of the relay pick-up. A feeder when fused according to the above formula may seem to be mostly "fused off," with only a small portion of the circuit connected solidly to the reclosing breaker. This is contrary to what has been considered good practice, which was to let the breaker "reach" as far as possible on all branches. An inspection of the new arrangment is apt to lead to the thought that the cost of reclosing equipment is not justified when it protects only 2 or 3 miles of a circuit whose branches total to 20 or 30 miles. It must be kept in mind, however, that the 2 or 3 miles left on the breaker are more important, from the standpoint of service continuity, than any 10 miles of lightly loaded rural branch, and that the reclosing equipment is protecting not merely the load served directly by the unfused "trunk" section but actually protects the entire load on the feeder.

•

Rate Schedule Suspended

Abraham C. Webber, chairman of the Massachusetts Public Utilities Commission, has announced that the new schedule of reduced rates recently filed by the United Electric Light Company, Springfield, has been suspended following charges by a labor group that it did not help the small consumer. The reduction amounted to approximately $110,000 (ELECTRICAL WORLD, October 23, page 106). Arrangements have been made for a conference to settle the dispute.

•

League Plans for Christmas

The Rocky Mountain Electrical League recently completed plans for a series of radio broadcasts to direct attention toward electrical appliances as Christmas gifts. Broadcasts are to cover the Rocky Mountain region and will supplement newspaper advertising by distributors and manufacturers.

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A line well guyed with Never Creep Anchors never bows to the pressure of the elements. The Never Creep gives you the best protection you can buy against line destruction by wind, sleet, ice and snow because it is the only anchor that pulls 100% against solid undisturbed earth.

The Never Creep is the only anchor on the market that pulls entirely against solid undisturbed earth. No area is wasted and there is no danger of slipping or creeping.

It is superior in principle, in construction, in ease of handling, in ease of installation and in final results obtained. There are only two pieces to handle, no frail parts to come loose or break, and the installation involves only three simple operations—drive the rod, bore the hole and hang on the plate.

It is easily retrieved and may be used for temporary guying. As a permanent guy it is one anchor that can be depended on for real permanency.

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October Allotments; REA Contracts Let

Among the allotments made by the Rural Electrification Administration during the month of October were the following:

MISSOURI—Northwest Missouri Electric Co-operative, partial, additional allotment, $102,000 out of $213,000 requested, 201 miles of line, 479 customers, Andrew, Holt, DeKalb and Buchanan counties. St. Joseph Railway, Power & Light is the source of power. Co-operative being formed, allotment $185,000, 196 miles of line, 467 customers, Barton County. Source of power Lamar (Mo.) municipal plant. Co-operative being formed, partial allotment $150,000 out of $347,000 requested, 325 miles of line, 906 customers, Lawrence, Greene, Dade and Polk counties. Source of power probably Empire District Electric Company.

SOUTH CAROLINA — Greenwood County, additional allotment, $11,000, to cover increased costs and an additional mileage not included in original contract.

TEXAS—Co-operative being formed, partial allotment $100,000 out of $244,000 requested, 275 miles of line, 560 customers, McLennan, Coryell and Bell counties. Source of power, Texas Power & Light Company. Co-operative being formed, partial allotment $100,000 out of $250,000 requested, 245 miles of line, 802 customers, Fayette, Lavaca, Bastrop and Colorado counties. Source of power Texas Power & Light. Co-operative being formed, partial allotment, $100,000 out of $222,000 requested, 224 miles of line, 853 customers, Fannin, Grayson, Collin and Hunt counties. Power will probably be supplied by the Texas Power & Light Company.

VIRGINIA—Shenandoah Valley Electric Co-operative, additional allotment 87,000, 84 miles of line, 301 customers in Augusta County. Source of power REA-financed generating plant.

MINNESOTA—Blue Earth-Nicollet Electric Association, partial allotment $150,000, out of $740,000 requested, 695 miles of line, 1,781 customers, Blue Earth, Nicollet, Lesueur, Martin, Waseca, Sibley, Faribault and Brown counties. Power will be supplied by Northern States Power Company, Interstate Power Company or the Lake Crystal municipal plant. Steele-Waseca Co-operative Electric Association, additional partial allotment $195,000, $95,000 of which will be used to complete original project. Remaining $100,000 will be used to skeletonize supplementary project area by building 68 miles of line to serve 186 customers.

ILLINOIS—Rural Electric Convenience Co-operative Company, partial allotment $100,000, out of $181,000 requested, 181 miles of line, 580 customers, Sangamon, Macoupin, Montgomery, Christian counties. Power obtained from Springfield municipal plant.

IOWA—Eastern Iowa Light & Power Co-operative, partial additional allotment $270,000 out of $388,000 requested, 375 miles of line, 926 customers, Scott, Muscatine, Louisa, Cedar and Clinton counties. Project derives energy from Muscatine municipal plant.

MISSISSIPPI — Coahoma Electric Power Association, additional allotment $47,000, 45 miles of line, 210 customers, Coahoma, Quitman and Bolivar counties. Project obtains power from the Clarksdale municipal plant.

WASHINGTON—Inland Empire Rural Electric, Inc., partial additional allotment,

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Lamp Replacers
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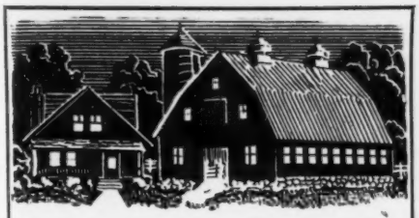

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$154,000 out of $592,000 requested, 530 miles of line, 1,093 customers, Spokane, Whitman, Stevens, Adams and Garfield counties.

IDAHO—Clearwater Valley Light & Power Association, additional allotment $287,000, which will make a total allotment to this project of $762,000, 709 miles of line, 2,229 customers, Benewah, Latah, Nez Perce, Lewis, Shoshone and Clearwater counties, Idaho, and Whitman County, Wash.

GEORGIA — Co-operative being formed, partial allotment $100,000, out of $398,000 requested, 375 miles of line, 1,584 customers, Hart, Franklin, Elbert, Madison, Stephens and Banks counties. Source of power will probably be Georgia Power Company.

Construction contracts awarded were as follows:

Valley Electric Membership Corporation, Natchitoches, La., has awarded a construction contract to Brown and Root, Inc., Austin, Tex., for building 216 miles of line. Low bid $150,812.

Southwest Louisiana Electric Membership Corporation, Lafayette, La., has awarded a construction contract to O. O. Fuller Construction Company, Nevada, Mo., for building 485½ miles of line. Low bid $321,903.

•

Okonite Completes New Film

How rubber insulated wires and cables are made and used is shown in a new two-reel sound film just completed by the Okonite Company, Passaic, N. J. The film will be shown without charge to those interested in the subject; both 16- and 35-mm. sizes are offered. Lowell Thomas is the narrator.

•

Patent Case Decision Given

Judge Edwin S. Thomas has filed an opinion in federal court at Hartford, Conn., holding that only one of eight claims covering patents of the Apex Electrical Manufacturing Company, Cleveland, alleged to have been infringed by Landers, Frary & Clark, New Britain, Conn., is found to be valid. Claims on the remaining seven patents are invalid.

•

Public Relations Poster

Stressing the importance of courteous attention to customer requests, Northern Indiana Public Service Company is currently using a poster addressed to its employees pointing out this fact: "You are the Northern Indiana Public Service Company in the eyes of every customer with whom you deal." Poster has been framed and widely distributed throughout its territory, the company reports.

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